AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of the Convention application made for a patent for an invention entitled

1. Wolfgang Wagner
Karlsruhe(Baden,GFR) (Birthplace),Resident:Berlin

do solemnly and sincerely declare as follows:-

1. I am the applicant for the patent

(or, if the person making the application is not the applicant)

1 ~~I am authorized~~

~~by the applicant to make this declaration on its behalf~~

2. The basic application as defined by section 141 of the Act was made in Munich(GFR) on the 7 th. day of September 19 85 by myself Sect.Berlin

PCT/ DE 85/ 00313

3. I am the actual inventor of the invention referred to in the basic application.

(or, if a person other than the inventor is the applicant)

3 ~~The actual inventor of the invention referred to in the basic application is~~

~~who is assigning the invention to the applicant~~

~~and is entitled to make the application for the following reasons:~~

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

(or, where a request is made under section 142AA of the Patents Act 1952, for an earlier application made in a Convention country to be disregarded)

4.-(1.) The basic application referred to in paragraph 2 of this Declaration was not the first application made in a Convention country in respect of the invention the subject of the application.

(2.) An earlier application in respect of the invention the subject of the application was made in Munich/Berlin on 7.th day of September 1984,now abandoned not publ.

(3.) A request has been made to you under section 142AA of the *Patents Act* 1952 to disregard that earlier application.

(Here set out in succeeding sub-paragraphs the facts that show that section 142AA is applicable)

The earlier Appl. P 34 33 365.7 relates to Fig.36-43,48,49,58;
The Partial Priority for the other parts of Appl.should be claimed

Except as stated in this paragraph, the basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

Declared at Berlin 65 this 14 th. day of March, 19 86

(Signature of Declarant)

TO:

THE COMMISSIONER OF PATENTS.

(IMPORTANT - Cross out inapplicable words in above Form.)

P 5,000

COMMONWEALTH OF AUSTRALIA

Patents Act 1952

APPLICATION FOR A STANDARD PATENT OR A STANDARD PATENT OF ADDITION

Form 1 – Regulation 9

AUSTRALIA
25 MAR 1986
PATENT OFFICE

I, Wolfgang Wagner

of 1000 Berlin 65, Exerzierstr.1 (Germany)

hereby apply for the grant of a standard patent / patent of addition for an invention entitled A DEVICE FOR AUTOMATICAL SELF-CONTROL OF METABOLISM

which is described in the accompanying ~~provisional~~ complete specification.

**(To be included in the case of a Convention application)*

Details of basic application(s) – P 34 33 365.7 Munich 7th Sept 1984 PCT/ DE85/00313 Entitled: Injektions-

Number of basic application voorichtung mit Sensor, Injection Device With Sensor

Name of Convention country in which basic application was filed Munich(GFR),

Date of basic application

**(To be included in the case of an application made by virtue of section 51)*

Number of original application

Person by whom made

**(To be included in the case of an application for a patent of addition)*

I request that the patent may be granted as a patent of addition to the patent applied for on Application No. Patent No.

in the name of

I request that the term of the patent of addition be the same as that for the main invention or so much of the patent for the main invention as is unexpired.

My address for service is Mrs.R.J.K. Chapman 278209
25 Jenkins Street, 7006 Taroona, Tasmania

Dated this 14.th day of March 19 86

Wolfgang Wagner
(Signature)

To :

THE COMMISSIONER OF PATENTS

This form must be accompanied by either a provisional specification (Form 9 and true copy) or by a complete specification (Form 10 and true copy).

* These sections are to be completed only where applicable.

C.J. Thompson, Commonwealth Government Printer

(12) AUSTRALIAN PATENT ABSTRACT
(19) AU

(11) AU-A-55604/86

(54) MEASURING METABOLISM DURING LIQUID INJECTION

(75) WOLFGANG WAGNER

(21) 55604/86 (22) 25.3.86 (24) 7.9.84
(31) PCT/DE85/000313 (32) 7.9.84 (33) WO
(43) 8.10.87
(51)[4] A61M 5/31 A61B 5/05

(57) The invention relates to the treatment of diabetics.

Claim

1. A device for the automatical self-control of metabolism of a mammal, consisting of at least one sensor which is to be connected with a measurement device and which is arranged in relation to a skin knob produced by a mechanical apparatus in such a manner that an additional blessure of the body may be avoided for the measurements.

P/00/011

Form 10

PATENTS ACT 1952-1973

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Class:

Int. Cl:

Application Number: 55604/76.
Lodged:

Complete Specification—Lodged:
Accepted:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant: Wolfgang Wagner

Address of Applicant: Exerzierstr.1 1000 Berlin 65

Actual Inventor:

Address for Service:

Mrs.R.J.K Chapman
25 Jenkin Street, 7006 Taroona, Tasmania

Complete Specification for the invention entitled:

A DEVICE FOR AUTOMATICAL SELF-CONTROL OF METABOLISM

The following statement is a full description of this invention, including the best method of performing it known to me:—

---

*Note: The description is to be typed in double spacing, pica type face, in an area not exceeding 250 mm in depth and 160 mm in width, on tough white paper of good quality and it is to be inserted inside this form.

11710/76—L C.A.Turnbull, Commonwealth Government Printer, Canberra

Dr.med.Wolfgang Wagner Berlin

A Device For Autcmatical Self-Control Of Metabolism.

A B S T R A C T

The invention relates to a cannula; it permits, by the particularity of its shape or features and by the combination with a measuring arrangement, to judge or check and to registrate conditions or states of metabolism; this is done,of course, before and during liquids are injected into the body of a mammal and preferably on persons suffering from renal sickness and mainly on diabetes. But essentially, the scope of the invention concentrates to an injector, which adapts, before or after the tissue sugar (content) is measured, correlates the measured data to a preadjusted dosage and a dossage correction; it adapts, if need be and corrections are necessary more frequently, the programming to the dosage automatically. Preferably, this takes place into a suction injector, which raises the skin by negative pressure or vacuum into the cannula, and which reliably considers the continuous operation of measurement and injection by control of the reventilation. Besides of the features of the sensor cannula with regard to its form and location and kind of sensor layers and electric or optical measuring feelers or sensors, the main-attention is directed to improvement of the suction injection as regard of handiness and simplicity of operation and prerequisites of a compliance. The manner of production of negative pressure or vacuum and of the dosing and of the steering of functions are dealt in this sense.

S P E C I F I C A T I O N

G e n e r a l O b j e c t :

The invention relates to the field of medical technology, in particular to injector technology, wherein the treatment of diabetics in the dispensation of insulin is improved by the invention. The patient is to be put in a position to regularly and repeatedly regognize the state of his metabolism so as to make it easier for him to keep a reasonable diet and to allow him, when deviating from a strict norm in his behaviour, to compensate said deviation by a commensurate insulin treatment. Therefore, the physician treating the patient should be accorded an extensive knowledge and insight into the nutritional comportment of the patient so as to put the physician in a position to match his dosing proposals for insulin relative thereto. This idea in mind, the problem poses itself to provide an injector which can be handled automatically as to its operation in such a manner that the person stricken with the disease can use it, but also to allow for an application several times during the day. To this purpose the injector should be of a construction which is small in size and easy to handle, safe as to its operation, constituting no hazard as to health and

capable of use with least inconvenience. It is an object to render handling thereof -also with respect to refilling it with insulin of using a new cannula- as easy as possible and the cost of manufacture as low as feasible. When applying said suction injector it is of particular advantage to combine therewith diabetometering in conjunction with the injection while raising or lifting the skin by means of negative pressure into the cannula, assuring in this way until the time of reventilating the suction cup a fixed union of injector and skin.
In this respect further improvements in the suction injector technic relate to adapting it to the storage, the mixing performance and the dosage of insulin but also to the generation and application of the vacuum or negative pressure.
The attempts during over fifty years with the project to bring the suction injection to an employment worth mentioning show, that only a complex treatment, whereby all functional parts and the human(above all but the psychical) constitution are coordinated one with the other, produces a solution, which is advantable and also manufactory useful. Opposite the disposible syringe with long stroke and incorporated cannula which meanwhile is easier to handle(but more expensive), a full automatic injector must be small to put in the pocket and handy, reliable in function, easily to use, favorable with respect to the costs. Concerning to the diameter of cannula it must be observed the minimum to avoid additional violation and molestation. Opposite to the conventional syringe must be offered additionaly essential advantages as those are given by the dosage adaptation according to sugar-measurements and including the possibilities of control and training and education are suitable to increase the compliance.

Investigations of metabolism directly at the bed of the patient by automatically taken samples are known long since, whereby also measuring data are stored(for example Hudspeth,C.L., Richardson,Ph.Cl.and others in DE 24 37 467). For example with the insulin-infusion-device Biostator of the firm Miles is became possible the continously supply of insulin by observation of glucose concentration in the last years. But the comparatively extensive apparatus is applicable only at the bed of the patient. The "Implantable Electro-Chemical Sensor", so as is specified by Leblanc jun. and by others(DE 26 45 048) is introduced inside of a coating cover into a vessel and serves to the observation of ion-activity. It shows liquid supply by means of a drop-infusion. It is also proposed to take blood samples by a laying probe for analysis(Clemens,Anton Hubert,E.Myers,R.Weston, DE 27 20 482) and the separated supply of glucose and insulin is controlled. To the here demonstrated invention at most Ash St.R.,Lafayette, Loeb M.P.mostly approach with their "Arrangement for the apply of insulin as required"(DE 30 50 155). To a insulin supplaying cannula a sensor with coating cover is attached directly for the common introduction under the skin. In contrast to a specific enzymatic reaction with glucose which is susceptible for disturbance the osmolarity of the blood is measured and drawed off from an eventuel deprivation of water by simultaneous determination of salts. The results of measuring are arithmeticaly fitted with the dose program. The insulin pumps, which must be weared with laying durable cannula, further useful, especially for juvenile persons and such with instabil diabetes serves to the apply of minimal amount of

insulin which is to control with the possibility of arbitrary alternable additional doses before the meals by the patient himself. (For example Haerten,R. and Kresse,H. DE 25 13 467).
A measuring device for blood sugar here is not present. Loeb,M.P. and Olson,A.M.(DE 32 41 313) give a curved arranged syringe which is to bear on the body by use of catheter. For the implantation into the body also several pumps with supply vessels are described. (For examples Cummins,R.D. and Park, O DE 33 43 708). On is occupated with the wireless transmission of demands for dosing to such a device (Prestek,K. and Franzeski,M. DE 30 35 670) and with function control over measuring dates out of the inner part of the body, whereby a locking mechanism is provided for the transgression of a limiting value of the insulin infusion. (Fischell,R. and Ellentuch, DE 32 47 232). Also the title "The Development Of A Needle-Type Glucose Sensor For Wearable Artificial Endocrine Pancreas" (Yamasaki,Y. Journal of Osaka Univ.,Vol.-2,Sept. 1984) should not deceive , that here is the question about a head-probe with a complicated layer structure which is implanted to dogs under narcosis and that the inventive scope of coating the cannula is not mentioned.
The sensors coated on wire of Wilkens,E. and H.G. Daniel,R. and others and Gough A. and others seem us more practicably, which are more exactly cited with the description of the sensor cannulas.
But altogether such "catalytic sensors" with the sense of current producing cells involve considerable problems, even because the continuous application inside of the human body is intended. Although optical systems also are not with less problems with regard to the competition of materials

(p.e.to the amino acids which turn the plane of polarization) Mueller A. was involved with in-vivo-measurements (DE 29 441 13) through external ear. Such obtained continuously measured data certainly could by applied for a better dosing correction in suction injection. Less awkward could be presumed to remain the measurement through the cannula. For the binding of cardiac glycoside and for other sugar derivates sepharose-concanavalin A is used some time. On the other side is known, that sugars are no-conductive and increase in higher concentration the voltage of a electrolyte solution; that the cause, that voltage measurements are used in the sugar chemistry to track down sugars (A fact, which I owe to the personal information by Prof.Dr.Mauch Berlin).

The plaster-adhesive fixation of skin during the injection has also precursors, but yet without a elevation of the skin.

Suction injection technic -i.e.injection by way of applying suction from within a suction cup onto a portion of the skin raised thereby- which has been improved upon by Applicant and which has been also disclosed starting on Nov.7th.1933 by M.Demarchi(US.PS 1,934,046) and by G.N.Hein (U.S.P.S.2,743,723 as of May 1st 1956), in several disclosures of Applicant beginning with 1974 (GB 1,494,325; 1,494,646; 1,513,463; 1,517,289; DE 25 51 991; 25 51 992; 25 51 993; 30 19 589; Australia 510,272; US. 4,139,008; 4,169,474; 4,284,077; 4,393,870; Can 1,189,412 and many others) whicn technic has not yet led to extensive use and application on account of imperfections in the human nature although human skin is well suited for suction injection, and this on

account of its particular elasticity and hypotrichosis or thin-hairiness. To start with, G.H. Hein disclosed already in 1956 a device whereby a premature penetration into the skin prior to the injection is safely obviated, yet the more important messure to provide for the right spacing from the skin to the cannula subsequent to the injection had been neglected. Likewise, the methods for generating the vacuum are also not satisfactory. In this respect, it is a matter of course, to satisfy the prerequisite for one-handed operation thereof in affording self-treatment to the diabetics. Moreover, the dosing system comprise a number of shortcomings. An injector disclosed by Stein W.(DE 1 491 840) uses, to be sure, the principle according to which drug feed is carried out from a supply bottle by means of the dosing injection piston via a valve disposed therein; yet, the necessity of separating ambient air from the contents of the supply bottle has not been dealt with. The injection without the use of a needle by means of excessive pressure or overpressure forbide itself when effecting long-term treatment on account of the damages to the tissue resulting therefrom. Besides, the necessity, to avoid that the patient would have to clean the component parts of the device, has, so far, been afforded too little consideration.

Advantages of the Invention:

It is to great advantage to the diabetic as well as to the patient with implanted insulin pump if he were able to find out his metabolic state without additional damage to himself by inflicting scratches of those parts of the skin of the tip of the finger especially rich in pain and without the

rather cumbersome procedure of applying a test strip and reading therefrom the colorimetric data, and to do this while effecting himself said injection or, selectively, even before actuating the injector piston. On the basis of those measured data and the dispensed doses of insulin it is possible for the patient and the physician to fully take account of his situation as to therapy, and also he will more readily understand it, with the help of his physician. When effecting the separate or individual measurement -possibly via the sensor layer or coat of the cannula as current source or via measuring the modifications in conductibility under the influence of glucose -with the aid of the cannula constantly replaced for a new one, sources of interference will be eliminated such as protein or electrolyte accumulation at the measuring sensor, which would render a long-term application more difficult. The suction injection present, in connection with the metabolic controlling sensor cannula, the particular advantage that the duration of skin contact is automatically controlled. Moreover, it is of advantage for measuring means to provide in the suction cup rim in the vicinity of the cannula a comparison or reference electrode which assures fixed adhesion thereof and need not be attached by specially provided means. Countersinking the cannula shaft to a type of skeleton cannula accomodating the drug guide channel will eliminate the necessity of providing for thikening or swelling of the cannula by the sensor coating or covering whereby an essential advantage relative to the painfull sensitiveness of the puncture due to the modern delta type ground cannula and suction injection would be cancelled. By way of di-

viding the cannula shaft into the metallic skeleton part and an adjacent sensor part -which may also be mounted on the hoses introduced into the groove-like cannula shaft- there is a possibility to effect a division between two electrically separated portions having their proper current paths, and to gain in this way an additional reference electrode.

A hose, which is shoved onto a such half-open cannula, may have a smaller clearing or lumen for piercing through the skin, which results in being expanded up due its elasticity. In such a manner, a more quickly injection may be rendered possible (p.e. such of viscous liquid solution or of a suspension, as retard insulins often represent). A further advantage results in the possibility, that foreign matter, which rests to the surface of hose, contacts with the tissue fluid or with the blood, but an introduction of such foreign matter can be avoided.

The automatic compensation of dosage relative to the respectively determinded metabolic conditions excludes miscalculations and misestimations as well as erroneous operation of the patient, while allowing for taking varying insulin sensitivity due into consideration. Moreover, the automatism of the program permits that a crudely erroneous program will be corrected by the physician or, also, an andaption to new conditions of living and nutrition without having to have recourse to the assistance of a physician. Applying instandly active unmodified insulin and depot insulin side by side permits that- similar as with the insulin pumps- a short-term correction can be effected in addition to long-term physical care. However, in this connection the detrimental effect of having to carry on one's body some

device or apparatus is eliminated as is the drawback of having to have implanted in the peritoneal cavity or in the subcutaneous connective tissue a cannula which may also constitute for the diabetic a source of imminent danger as regards wound infection. Programing by means of [illegible] segmented into blocks and notably disposed in the housing will, in this respect, facilitate the survey. The selection of the profile number permits print out of the entire program line into the file of the patient, and this without the use of complicated technical equipment. Closing the program away and restricting the possibility of compensation and changes of program by the patient are indispensable prerequisites for avoiding serious incidents due to misconceptions, self-willedness and lack of discernment of the patient or deliberate interference of third parties. It appears of particular advantage to effect, as regards the domain of vacuum generation, an advance or shifting forward thereof into the phase of industrial packing of the cannula, and this in particular when this is done because of the higher expenditure of the tripping mechanism for a reservoir cuplet preserving said vacuum and surrounding the cannula to be used but once on the injector which is used over and over again. It is possible in this connection transform modifications in the surface of the reservoir cuplets during the sucking up operation of the skin into pulses via feeler members of the injector so that direct skin contact of the feeler for tripping operation can be omitted. When using using electrically operated dosis dispensation especially the solution of vacuum generation presents itself via rarefication of air within a heated chamber. Employ-

ing a plurality of chambers increases the independence from the mains and, hence, its wide range of multifarious daily use. Likewise, the advantages of a permanent vacuum controlled or adjusted according to the instant command or deed can be exploited with a handy apparatus by employing gas- or injector pump in connection with a common household carbonic acid cartridge after the [illegible] account of the high gas output pressure and [illegible] icing when the gas is expanding- is removed by means of a special shutter or paddle valve. Ideally, vacuum generation can -in view of the low vacuum requirement- be carried out in a spring operated cylinder-piston pump when, by filtering the air from the suction cup, it is obviated that piston and cylinder are affected by the finest quartz grains from the pores of the skin with respect to their surface finish or skin effect. Suitably, the vacuum preparation is shooked up with the movement of a catch cover for the suction cup, while also actuating the mechanism for replacing or changing the cannula. Bowden cables permit a space saving power transfer. The fact that clamping or locking of the suction piston is carried out on but one side by lateral grip means with the risk of cogging the piston is counteracted in that the suction piston is held by magnets and spring locking means already approximately in snap-in or engagment position. The quantity of power that need be applied for tripping from the suction cup is, therefore, considerable reduced. Also, a delay of pump movement sets in which can be used for closing a pressure relief valve. This latter effect is to divert the air compressed in the suction cup by having

PP. 12 IS MISSING FROM FILE

fore resiliently held by grid or a central pin within the suction cup, serious cuts on the skin are obviated when the device is removed, inadvertently, tangentially from the skin after having been used. It is also an advantage that the cannula magazine as a whole can be moved under the effect of suction in the suction cup into a septum connected to the magazine -descended on the skin prior to injection and raised again upon reventilation.

In the field of operational control, in particular as regards operation safeguard between the steps of skin suction, drug injection and reventilation of the suction cup advances will also be described. In this connection, a central pin within the suction cup in the vicinity of the cannula establishes the stroke and extent to which the skin has been raised. The three trippler pins also, which are spaced about the periphery of the suction cup, as shown in other embodiments, have been improbed by suitable spacing and arrangement and in that their spring-back resiliency onto the skin, subsequent to its having been raised, is cancelled and reduced.The interval or space from skin to cannula is assured, subsequent to injection and in order to avoid cut wounds, by spring-back action- being in part blocked during injection- of the suction cup. Reventilation of the suction cup is, safely, effected first after the injection has been terminated (in the embodiments with mechanical control) when a spring mechanism has actuated the moving members controlling the dosis up to running up to the obstacle limiting dosis. The spring mechanism is to be equated with the magnetic attraction of the ventilating valve, flutter of said valve -when applying permanent suction- being prevented by means of a special locking mechanism.

The central pin occupies suitably a central point of an elliptical suction cup, with the cannula occupying the other for keeping the necessary distance of the seals about the the central pin and the cannula and of the suction cup rim. By using a swelling pin for lifting the gas capsule in the mandrel renders a relatively weighty screw lock and a mode of handling superfluous which requires much force. As regards storing and feeding the drug or preparation is effected so that a uniform flow of the drug is safeguarded towards the dosing device. A process of refilling, so as to build up a residual amount to accumulate as dosis which can be applied, leads to saving expensive hormons, in particular when magnetic locking means allows the exchange of the supply reservoir only then when the one used has almost completely been exhausted. With regard to dosing, the dosing precision is increased by avoiding lengthy and extensive connecting hoses with wind-kessel to the cannula. If the dosing device had been disposed as short-stroke piston or collar in the end of the drug feed hose outside of the container immediately or shortely before the cannula and if said device is actuated from outside said hose, it is possible to solve the problem in a milking-type of motion by periodically applying pressure from the outside of the hose in an electromagnetic construction in a manner such that the moving members in the hose can be omitted. Useful to this purpose is merely a pin carraing an an annular ledge within the hose as abutment. Short shaking movements for agitating zinc chloride as addition to depot insulin are necessary for obtaining an injectable suspension. For space reduction the control of a discharge valve is provided in conjunction with a flow measurement.

Differences of the stroke velocity, which are mediated piezoelectrically or by switches to solenoids, or a running back of the motor, which is used for the propulsion of a control gear, safe wheight for further motors applied for several dosing mechanisms in a considerable manner.

The use of auxiliary fluid instead of the drug for dosing (utilizing the displacing effect) saves or facilitates the cleaning of the dose mechanism. If thereby the auxiliary fluid is brought behind the piston of a syringe for multiple use, so the higher viscosity of the auxiliary fluid hinders its admixing to the drug. Space for the auxiliary fluid can be saved considerably, if a arresting piston is applied which moves up to the separating piston, so that always the same limitid amount of fluid swings back and forth between the dose mechanism and the syringe for multiple use.

Solution of the Problem:

The problem on which the invention is based is solved in that one of the cannulas employed to input fluids is also devised as sensor which will, once the cannula is introduced into the body of a mammal, according to the invention, transform physical chemical condition changes in the bodies of these mammals into measuring signal changes fed to a measuring instrument in order to render these physical chemical condition changes visible.

The sensor may be used itself as electric voltage source, the changes in tension or the intensity of current supplied are employed for processing the measuring signals. The sensor may, hoever, also change, under the physical chemical influence of the the bodily state, its conductivity for electrical currents supplied from outside and to transmit, in this way, metered data to the measuring instrument. At least on parts of the cannula shaft a layer is (or several leayers are), as a rule applied, which layer (or layers) will produce the properties of the sensor. This sensor covering reacts in keeping with the main use or application of the invention, on the cannula shaft mainly with the body glucose in order to react therewith in the manner of an electrical cell or to change, by accumulation of glucose or their reaction or synthesis products (such as glucose, starch or also lower carbohydrate chains) the conductivity via the cannula as a function of the glucose concentration of blood and tissue (depending on the position of the cannula within a blood vessel or in the subcutaneous tissue or in the peritoneal cavity). By removing a part of the cannula shaft behind the can-

nula tip whereby its grinded surface is preserved, it is possible the shaft wall to be supplemented by synthetics, its sensor properties having been emparted predominantly in the electrical isolation from the shaft of the cannula. It may, however, also be placed, for discharging fluid and with sensor properties on the surface in close connection to the bore of the injector adapter piece or -where such is not existent- towards the infusion hose in such a groove-like recessed cannula shaft, without it being necessary that its free end must unconditionally discharge via the cannula tip proper (with very short cannula shaft this may turn out, however, to be appropiate to assure drug injection under the skin). Even though a sensor cannula of this or similar type may appear to be useful for being applied in the dialysis of patient having renal insufficiency (quantifying the metabolic products retained in the body or the water and salt ballance), it seems that, in the possibility for detecting the measured values over as more extensive period of time the application of insulin pumps with lying cannula are particularly advantageous. According to the characterization in subdividing the cannula shaft in at least two compartments electrically isolated from one another the advantage obtains that an additional comparison electrode outside of the cannula may be spared. Electrical conductors are suitabel located within the infusion hose, over stretches thereof, and connected (embedded in and isolated by the wall) to the meter. When using the the sensor cannula for a unique injection, the opportunity is expoited according to the inventio n that the sensor coat of the can-

nula is modified under the influence of products of metabolism, particularly saccharide or in particular glucose, and this irreversibly, so the extent of these modifications being used for determining the measuring parameters. In particular glucose can be bound to the coat of the cannula (e.g. to vegetable e charcoal or ferment conditioned), and it is possible to reduce, by the enrichment of the saccheride being as conductor an insolator, the conductivity of the sensor coating, being selected as good conductor, as a function of the offer of saccheride with due consideration to the time function.

A further solution is the miniaturization of optical measurements and its transfer towards the region of the cannula. Therefore light is directed against an optical indicator zone through at least one light conducting fibre or directely through the cannula shaft, and light, which is altered reflected by the influence of products of metabolism, is measured and evalueted. An other solution without colour indicators uses polarized light and the property of any products of metabolism (thereby also of the glucose) to alter the polarization plane? depentent from its concentration. The polarized light is deflected according the invention from a medium of other density, which preferably is inserted on the area inside of the cannula tip, after the contact with the product of metabolism and it is comparised with a reference ray or an standard of measurements by means of suitable detectors. Keeping within the time span required for measurement and injection is best assured when using the suction-type injector, i.e.when the skin is drawn in, by way of the negative pressu-

re of vacuum within a suction cup surrounding the cannula, and retained for such period of time until the suction cup is again (by pneumatical control) reverted. When using suction-type injection, the rim of the suction cup can be metallized (e.g.coated with silver silver chloride or while applying a contacting jelly or an electrode ring bondable on both sides) as counter-electrode. Instead of the raising of the skin by suction such raising may be performed by plaster-traction. Termination of measurement and the computation process for updating the dosage to be dispensed can be exploited as an alarm signal for the dosage pump. In this way the injection release or tripping by earth contact of the cannula -advantageous in and by itself- within the skin as raised up may be dispensed with.
(Depending on an "earth contact", which is in reality the contact with the body as sender, from the closeness of outer electrical fields, would have made it necessary to assure the release via the closing of circuit with the aid of the skin as conductor, which principle is exploited according to the invention when the measurement instrument fails). It is an essential part of the construction of the invention to use compensation of a bad metabolism adjustment within a medically programmed frame over additional doses of unmodified insulin calculated as favourable or by the withdrawal, calculated as favourable, of doses of depot insulin. From the practice the physician has gained in having his patient cooperate, the problem arrises also to enable the physician so as to limit the dispensation of an arbitrary additive dosis of unmodified

insulin just before planned meals. On the other hand, there are situations in which a program automatism is appropiaste which permits, automatically and without any interferende from the physician (insofar he does not block this opportunity with patients unqualified in this respect by means of the device provided herefor) to finaly correct eroneous programming and to adapt programming (if necessar, also without the collaboration of the physician) to the modified circumstances of life and of nutrition. The measured values and the doses dispensed as well as the type of influencing the program as set may are printed out in the apparatus. Moreover, in addition to or in place of a printer one may also provide an electronic storage unit for the measured values (and those of dosing) which may be displayed on the physician's screen or plotted as succinct curves. Even when using a permanent infusion cannula it is advantageous to exploit the opportunity of a single and unique measurement (for determing the intial metabbolism condition). Likewise, it is an advance provided by the invention to provide for programming via lock-type rotary contactor rings combined to form program blocks, since they give a simultanwous overview over the point of departure in programming. By means of print-type elevations of the programming symbols and their arrangement to an entire horizontally extending programming line a print-out of the program envisaged in the patient's file or elsewhere can be effected without having recourse to auxiliary technical apparatus. Locking, against inadvertent turning of the contactor disc beyond the snap-in stage or posi-

tion by exerting a lateral pressure by means of a screwed joint operable with the aid of a key, is facilitated by a lateral profile formation on the carrier or support ring mounted underneath of the contactor rings. Between carrier ring and stop or click-stop ring there is respectively a sprung-back play in contacting guidance to the control unit so that desired or control values -even as modified by sequences of automatic operation- can be rendered visible on the display unit. Signalling an alert for an imminent exhaustion of the drug or preparation (or cannulas also), which can be influenced by the patient, is also provided so that, under the control of the computer, it is possible to effect replanishing of a nearly exhausted drug supply with respect to the final or terminal dosis, allowing in this way the reservoir to be almost completely emptied. A lock (electromagnetic or mechanic) permits the patient to override same so as to effect replenishment himself and to enable him, however to put off the time setting by replenishing thereafter using a large amount of the drug or preparation. For those cases, wherein e.g.it would be required, for measuring conductivity, to have part of the lumen of the cannula also covered by a coat (to deviate the need of having to enlarge the cannula diameter -with the imminent risk of injury), a small amount of the drug (e.g.in the form of a unique volume-reducing base stroke) has to be provided from the dosing pump dor discharge even prior to the cannula penetrating into the skin. In this way it is prevented that blood of tissue fluid will be aspired over the capillaries and that across these capillaries current will be conducted as shunt. (Provided that the

drug is practically a non-conductor). If finest hoses and capillaries are used inside of the cannula lumen, the injection is suitably begun before the measurement is completed to limit the time of the contact with the injector. But the pressure of injection is limited on account of the violation of tissue. The computer is able to start a limited immediate correction of dosage subsequent to injection of a basis rate. The device for suction injection proper has undergone further developments covered by the invention, leading to a reduction of size thereof -not at least consequence- so that it is possible to associate therewith additionally the measuring and control unit for the sensor cannula, and this without diminishing its handiness. Due to the fact that the vacuum requirement of the suction cup is relatively small and the human hand is capable of exerting a considerable concentrated force, a piston cylinder pump with pressure spring accumulator remains an economic method. Yet, to be sure, it is necessary to interconnect in the suction channel a sand filter between the vacuum pump and the suction cup so as to prophylactically guard against fine quartz grains from the deterioration of the piston cylinder face, as they will be pulled out by suction from the fine pores of the skin. Operation of such a pump is carried out, for reason of spatial economy, via Bowden wires. Tensioning operastion for the spring is appreoriately connected up with the hinge motion of the cover above the suction cup. The suction piston is locked starting from the suction cup by wakening the break-away force of the spring by means

of a clamping arrangement or of the adhesive force of the permanent magnets. In this way the risk of cogging is decreased when tripping the generation of negative pressure takes place unilaterally and excentrically from the suction cup. The delay effected by this relieving or unburdening mechanism acts favourably for closing a spring-weighed pressure relief valve compensating the air pressure compression arising when the suction cup contacts the skin and when the suction cup is raised towards the cannula. Raising the suction cup rim against the force of the spring and releasing the lock of return movement of the suction cup during reventilation or reventing bring about that there is a distance between cannula and skin subsequent to injection. This same problem can be solved by the use of a central pin centrally raised in the suction cup (on account of the procimity of the cannula advantageously in the center of an eleptical suction cup) and sealed thereagainst during the suction action on the skin, and it being pressed against the skin under the action of the spring during reventing okperastion of the suction cup. Spring tension for such auxiliary functions with concomitant extensive expenditure of force becomes effective when closing a cover slide (having memory function for imperfect availability for use of the device) so that the pressure of the central pin, serving as release or trip of the vacuum pump) on the skin can be mitigated. In general, the feasibility was tested to deflect the pressure of the tripping pins subsequent to rendering the vacuum operational, which pins project thereover, initially, starting from the vicinity of the suction cup rim. This comes

about by the effect of the wedge-type slants onto a flexible ring unblocking the upward movement of the pin, with but little friction, after having passed said wedge-type slants. Resetting movement up to the flexible rings on the wedge-type slants becoming effective is carried out via an elastic collar annexed on the suction cup rim, which tripping assures a seal with respect to the skin. The resiliency of the tripping pins has the effect that the stability required for the suction cup rim is assured so that no ambient air may penetrate below the suction cup rim during the application of suction. In vacuum preserving or retaining suction cuplöets, wherein suction as required has already been prepared in the industrial manufacturing process, the relief of said vacuum is transfered onto a tripping mechanism in the device subsequent to the locking during storage, and this by the holding or retaining function of a cover. Inasmuch as the accumulator or damming effect of the skin with respect to a valve pin in a tublet parallel to the cannula has turned out to be unreliable, this mechanism was improved in that a resilient stay or strap, starting from the valve pin, projects the suction cup

in the form of an arc toward the skin. The ends of the stay or strap rest on the rim of the through which air penetrates gradually, after the suction has been switched off, into the suction cup. It is also an advantage of the invention as regards the dosing operation in the quantitative transport of the drug or preparation in the quantitative transport of the drug or preparation via three valves closed in pre-

determinated sequence to have electromagnetically operated pumps fill hose rings with an auxiliary fluid, preferentially via dosing chambers bordered by perioheral rings and on a pin in the drug hose close to the cannula adapter. Also, piezo-electric actuatorsor regulating members surrounding the hose may be employed as dosing valve. The operation of a dosing pump for transporting a (normally viscous) liquid such as paraffin avoids that the components of the pump come into contact with the drug or preparation, thus economizing on cleaning. The auxiliary fluid or liquid may also be introduced behind the piston of a step syringe or syring for multiple use, giving rise to the effect of a dosing hydraulic system with forceful and slow advance of the piston of said step syringe. The piston may be formed of wax or comprise a wax-type envelope, whereby the expensive sliding fit may be avoided. A particular coupling valve is comprised of a slide valve with spring-back action in the component part of the apparatus and of a slide-type collar above a lateral opening for the admission of the auxiliary liquid in the step syringe, said collar being slidingly moved by locked action when the step syringe is inserted into the apparatus. An air-free coupling of both liquid systems is assured in this manner. The concumption of space for the auxiliary liquid, mainly, may be saved, if only an amount which surmounts the single dosis stroke together with the leaking-loss, is injected by the dosing mechanism between the separating piston and a supporting piston, and if the supporting piston is led gradually in each case and than is locked according to the motion. In such manner the auxiliary liquid shuttles between the dosing pump

and the interspace of pistons and the separating piston and the supporting piston move one after the other.

With the respect to the generation of the vacuum a type of sluice valve terminating the groove on the mandrel of a pressure gas cartridge is of importance, wherein a seat valve of small dimensions within a plate or disc of a larger seat valve is pushed open, initially with a slight expenditure of force. The highly compressed gas banks up or accumulate then in a chamber which is closed by a slide valve behind the seat valves. On the account of the equalization or compensation of pressure in the chamber it is then possible to push the large seat valve open, and this with little effort. The flow of gas will then stream via the opened slide valve into the gas jet pump. Raising the gas capsule in the mandrel may be effected by means of a swelling pin (e.g.formed of agar-agar) while taking up water.

The automatic exchange of cannulas is facilitated by the use of stacking cannulas, in the vertical arrangment in a magazine tube or hose the repectively antecedent cannula shaft has been received in a recess of the body of the following cannula. The feed of the drug is carried out laterally via a ring-type or annular groove in the body of the cannula having a bore opening up into the cannula shaft. At the end of the chamber in said body for receiving the adjacent cannula shaft an elastic septum may be centrally pierced by said cannula shaft. A cut between two cannula body halves may also be provided so as to allow for stocking in bent magazines, about which cut bending action can be effected. Drug feed may also proceed via verti-

cal grooves along the body of the cannula. bonds or thread-like adhesion between the cannula bodies may constitute means for affecting transport by means of traction which is preferably exerted from the claws, attached at the end of the cover of the suction cup to a take-up tube, onto the used cannula sticking out from the magazine. Pressure action on the stacking cannulas may originate from compressions springs tensioned by the pushing effect of the cannula already used when they are slidingly pushed by hand in the operational cycle magazine. A leaf spring may be used as tripping or contactor mechanism, which spring is actuated by means of a tripping pin on the cover. Raising of the central pin in the suction cup will permit, via spherical snapping means, the cannula to be stepped down, a process arrived at in this other embodiment by using the effect of compressed gas onto a sealing piston in the hose of the magazine(Fig.18,19). Flattening or oval shaping of the magazine can be exploited as safeguard against rotation while warranting the effectiveness of the hinge members between the cannulas a well as providing for an enhanced abutment and sealing effect of the channels wherein the drug or preparation is conveyed(Fig.27).

To blend thoroughly the components of insulin within the area of a hose pump which is driven by a spiral spring at least one peg fastened on a disk on an axis of this pump is moved by means of a second spiral spring over a gear-like uneaveness of the opposite face of the disk which bears the rollers of the hose pump so, that it will be caused a jerky and repeated evasive movement of the hose pump against a spring.

The precision of dosing by small circumferences is increased by this means thus two hoses are parallelly led over two identically working hose pumps, further by this means thus the hoses may be capable to extend only between the excavations of the disks which bear the rollers within the pump, further by this means thus the sector of hose between the pump and the cannula to which they are reunited for example, is surrounded by a solid cover to diminish the windkessel. Still a better solution is brought about by the insertion of a small piston pump immedtately before the cannula attachment piece, whereby that effects the drug delivery either by the coulisse of a disk driven by spring power by functioning of a solenoid which is repeated equivalent to the dosing. The bearing of the piston pump within the drug hose when actuating it from the exterior by way of a cross plate at the pump rod eliminates the necessivity of cleaning and facilitates the exchange of the dosage system in keeping with the objectives of the invention. Particularly advantageous for keeping the costs of production low is the replacement of a cylindrical piston by an elastic collar the cavity of which is being pressed against a contact surface by means of a rod so as to deliver the dosis, wich surface is the contact surface of a tranpierced plug laterally welded to the hose, the end of the rod passing the bore of the plug being enlarged and closing with its reciprocating action the plug bore towards the cannula attachment piece. It is possible, in a particularly advantageous manner, to eliminated also the pump housing when the plug(114) is directly introduced into a hose enlargement such as plies of fabric by vulcani-

zation, whereby the hose enlargement is only limited capable to expand inside of the axis bush of the injector(Fig.92). The motor of the dosage device assumes here, additionally, the function of the vibrator for thoroughly mixing the drug or preparation and prevents a permanent squeeze on the hose by means of the pump rollers; which squeeze will continue to constitute a problem even when, as shown in the example illustrated (Fig.65), pinching or squeezing the hose by the rollers always in one location will practically prevented by running the rollers in one direction while adding therto the dosage paths, and this with highly probability. To have but one hose between the encompassing recesses of the support or carrier disks for the dosage rollers prevent the hoses from the extending within the pump, which is compensated additionally by means of spring action at the end of the hoses emerging from the pump. Another variation is to radially dispose two roller pairs each one above another in such a manner as to enclose the hoses therebetween(Fig.73). Likewise, in other variation, it is possible to counteract the traction of the rollers by providing for a fixation of the hose pair via a cross stay between the hoses, which cross stay is in the form of a rope ladder spaced for a fixed gear ring(Fig.74).

For the storage of the supply of the drug or preparation an easily contractable thin-walled membrane, i.e. a simple bag, was used for reason of simplicity. Since, however, drug feed by means of pressure exerted in a container or vessel substantially facilitates dosage operation free of air bubbles (it is possible for air also to penetrate under partial vacuum from the cannula into the hose or flexible tube system, or it may alsρ be

the case that a return suction effect sets in via the cannula in the direction of the somal tissue). improvements were carried out in this respect also, and this in such a manner that this pressure onto the supply of the drug is effected uniformly from the very outset complete exhaustion of the drug supply. This is eftected by screwing down the cap or cover towards the bellows conveying the drug, and this is done at a rate proportional to the doses of the liquid medium dispensed(Fig.77). In such a way a crude dosing, similar to the use of a step syringe, is effected which is, however, supplemented by the reciprocating or piston pump for fine adjustment dosing. In a second example using compressed or pressure gas padding(Fig.81) this effect is obtained by the delayed release of carbonic acid gas by having diluted hydrochloric acid react with calcium carbonate, the latter provided on a polyethylene foil may be protected by a pectin film which is gradually decomposed by said hydrochloric acid. A pressure control valve prevents at all times that the pressure will rise excessively. The reservoir or supply cylinder receiving the bellows may suitable be a constituent part of the device, while the bellows contiaining the liquid drug or preparation will be replaced or exchanged. For the production of carbonic acid in an amount, which is necessary for the expulsion of 50 milliliter of liquid at a reserve pressure of 1 atmosphere overpressure, 375 milligram natrium bicarbonicum and 815 milligram hydrochloric acid of 2o percent. If calcium carbone is used therefrom 446 milligram would be necessary. To connect with the foil the heat-resistant calcium bicarbonate should be prefared, because it may be blown heated over a foil or it may be scattered

on a polyethylene foil which is heated of 100 until 120 ^{o} Celsius.

A precautionary warning or alert indicated before the drug supply is used up is effected, in keeping with the invention, by a gradually lowered screw cap or cover -which is visible by inspecting the slot of the cylinder or the dosing scale- encountering a removable obstacle inserted there at a location of the lower limit level suffient for but one sole dosis before exhaustion of the supply (Fig.77). Alternatively, it is possible also to mount, in particular within the pressure gas supply bottles(Fig.94) hardly inspectable, a thread between the bellows and the cover, which thread or yarn will actuate the alarm when tightened just as in electronic musical cards triggering the tune or melody. Finally, the drug consumption may also be monitored by electronic computation (Fig.92), or it can be read(Fig.93). In this respect, a pre-alert range may be selected and the injector may be prevented from functioning when a rest amount is found to fall below the quantity required for a single dosis.

Many improvements have been provided for operational control. Thus, in the solutions presented with spring mechanism -as with the hose pump- control simulation means for triggering the injection or reventilation simultaneously with the insertion of the vacuum reservoir is biased. Consequently, it is not necessary to actuate, in a cumbersome manner, some particular lever; rather, positioning or controlling elements are provided as pins projecting downwardly from the cannula attachment piece. Three pins are located in ports outside of the clover-shasped suction cup rim(Fig.85), thus enabling the releasing or

tripping pins to approach increasingly the center of the device, without diminishing its adhesion on account of a reduced skin contact surface. Pins housed within the suction cup must be sealed relative to the suction cup roof(Fig.22). In the example illustrated, these pins will,
firstly, effect rotation of the ring against the action of spring so as to move upward at low friction(Fig.79). By means of this rotation of the ring pins moved from the opposite direction will engage apertures in the ring and the lowering effected by manual pressure enables the valve between suction cup and vacuum reservoir to be opened. In the example discussed, the negative pressure or vacuum is generated in three chambers of same volume disposed annularly about and above the suction cup(Fig.82), viz. air dispersasl by means of electical resistance or heating wires over the mains. Heating the chamber is shut off via a temperature sensor (e.g.a bimetallic switch) or a time interval switch after the highest temperature has been reached, whereupon the chambers are cooled. Resilient flap valves permit the out air to leave the chambers via the suction cup, serving -by way of secondary effect- also as cleaning means, while the pins acting as levers move one of the respective flap valves from above and for the surpose of air pressure compensation between chamber and suction cup from their seat. Inasmuch as a broad rim in the form of the brim of a hat around the suction cup edge is useful at all in order to prevent an injector of elongated construction from being tipped or canted on the skin as well as from having air inadver-

tently introduced into the suction cup, the increase of space required for the heating chamber is not so significant when confronted with the savings accruing from the industrially evacuated cuplets about the separate or individual cannula. Dividing the annular shell about and above the suction cup into three separate chambers permits the injector to be used three times subsequent to each effected heating. The vacuum reservoir cuplets were also considerably improved. Thus, a membrane cover or cap about the cannula aperture cone permits, subsequent to loosening a support of the cannula, or the pin(Fig.65,88) due to injection moulding of the cannula, a deeper immersion of the cannula into the skin to the extent of the portion of the cannula shaft or shank located in the reservoir. In other embodiments the suction cup is formed by an injector collar made of rubber elastic material(Fig.77), into which the vacuum reservoir is slid in sealing relationship thereto. A twin-chamber storage system of this type, wherein a distinction exists between the space of the reservoir and that of the suction cup and wherein the cannula projects without being covered, resembles hence a store of reservoir of a single-chamber system having the cannula in its entirety and up its point located behind the terminating membrane. The clearance space about the overhung portion of the cannula shaft may be reduced while economizing on suction so as to be taken up by a annular piston. It is possible to suppress a special valve between suction cup and vacuum reservoir if an extensible membrane is used as partitioning wall between the annular piston and the vacuum reservoir;

such a membrane being possible a foil strip as commonly used in a household(Fig.77,84). In this case, however, the cannula piston must be arrested prior to use from moving towards the vacuum reservoir. It is provided, according to the invention, with a transverse slot into which, starting from a retaining collar or from offshoots of the cover, holding tabs extend from the lower margin of the vacuum reservoir into said transverse slot, thus preventing prior to use and under the effect of the vacuum the inward motion of the annular piston. Retaining pins or lamellas, which assume -subsequent to the removal of the holding collar of the suction cup cover- the function of retaining the annular piston up to the point for triggering the injection, snap into engagment in sections of the annular transverse slot between the holding tabs when inserted into the injector. With respect to manufacturing, the expensibe transverse slot can be replaced in that in the same form or mould with the vacuum reservoir an annular piston is manufactured having an open annular notch. It is then conveyed by a revolving transport system to a sticking device, e.g.an ultrasonic welding head, and then united with acircular stretch-foil. Subsequently, the annular piston is conveyed below a vacuum reservoir cuplet and the borders of the circular foil are bonded to the rim of the vacuum reservoir. This rim is shaped in keeping with the invention so as to constitute a broad brim of a hat, and this rim may simultaneously have a linear sealing contact with the suction cup collar of the injector. The transverse slot and the annular notch, respectively, may be constructed in alter-

ning sectors either horizontally or obliquely so as to contribute to enhancing, on the one hand, the locking effect of the cover tabs or the collar pins and, on the other hand, however, to contribute to facilitate unlocking the holding or retaining pins or lamellas of the injector(Fig.84). Due to the fact that the cover of the vacuum reservoir is rigid in this embodiment, the approach of the cannula, when in use, is effected -in addition to the skin being raised- by the resilience of the suction cup collar. Increasing the clearance of motion between skin and injector may serve the purpose of relieving the vacuum effect on the skin within the suction cup, but also, on a subsequent section of operation, of triggering the dosage device for injection. In the example of Figure 65 the correct vertical guidance in the movement of the injector towards the skin is a prerequisite for actuating the triggering operation in that raising the suction cup sollar can only be effected simultaneously with a cylinder segment raised and which comprises, towards the outsinde surfac ə of the cylindrical accomodation for the vacuum reservoir, a snugly fitting ring which locks against the wall of the accomodation when guided unilaterally in its motion. In this way is assured that the injection is triggered or released only subsequent to secure contact, a contact supported by vacuum, of the suction cup with the skin. In the example of the Fig.81 the release or triggering of the rotary pumps is effected only after the vacuum effect on the skin has been ascertained, just as has been disclosed in previous patent specifications of Applicant. In this instant a feeler is used as "suction switch". This feeler controls modifications

of the shape or form of a membrane or diaphragma to be lowered prior to injection. A circumscribed elastic portion is drawn inwardly under the influence of the vacuum of the reservoir; once the vacuum has been decreased by due compensation with the suction cup space or chamber this membrane lifts up slightly. The exploitable effect, however, very small. For this reason, a sliding valve, operating at low friction, has been provided as connecting or tripping element. The feeler associated therewith is, to begin with, advanced t means of a pneumatic piston towards the elastic membrane opera ted by the bellows which is compressed when the vacuum reservoir is inserted in the injector and which remains in said compressed state until such time as the space above the sliding valve has been reventilated. The re-expansion, perhaps reinforced additionaly by an auxiliary spring, of the bellows actuates the connecting or tripping element for the further functioning of the device(Fig.75). A slight marginal projection of a bonded cover membrane may afford resistance for a resilient holding device, thus eliminating the need for an expansive transverse groove. Contrariwise, wedge-shaped means acting laterally on the cover may be useful for removing the vacuum reservoir subsequent to use(Fig.69).

A single chamber system will, once more, become economically feasible when the expensive release mechanism for the suction cup cover supporting the membrane is transfered to the injector proper (Fig.86). An extensible elastic membrane bridges over a bottom ring within said vacuum reservoir cuplet. An inner portion of said bottom ring is bonded together with an additional annular cover ring lying with its rim on the lower rim of the

vacuum reservoir cuplet and preventing, subsequent to the evacuation of the latter, the bottom ting to be raised for so long until a border strip of said cover ring along a predetermined breaking line is removed by pulling downward. As duly intended, this is effected first after, initiated from the injector, pins or stop segments, at the level above said inner conductor cylinder at its border and passing through thinned out wall ports of the vacuum reservoir cuplet, assume the support function of the bottom membrane. In the single chamber system the cannula, as a whole, is located protectively behind the cover membrane, the disavantage of a trucated cannula tip is of less concern in the membrane passage in the formerly utilized rubber membrane than in the highly elastic synthetic sheet foil. The condition, that after opening the membrane lock by the cannula attachment or adapter piece of the cannulas, the vacuum of the reservoir will become effective thereinto can be exploited to the effect to render the negative pressure or vacuum laterally visible by collapsing an elastic small ball. If, in the case of deeper injections, the cannula of elongated construction destined for such dephts will hit upon a blood vessel, the small ball or sphere will fill up with blood once the clamp(210) has been loosened or detached. A faulty injection into the blood vessel may thus be prevented by interupting the injection(Fig.86). The single chamber system is provided with the largest vacuum storage space with respect to the overall dimensions of the vacuum reservoir cuplet. Also, the sterility of the cannula is safeguarded even without being externally wrapped or packed. The functional control for reventilation the suction cup has been improved upon in that an easily

actuable sliding valve is being closed, firstly, with energy accumulation for the return of the valve rod, prior to actuating the dosage device. The valve reset mechanism is, however, blocked until the dosage mechanism has run full course, the reset mechanism being actuated by the deflection of a mobile stop element at a steep flank of the connecting link guide at the housing(Fig.68, Fig.76,Fig.80). In this manner the risk of reventilation even prior to the dispensing the amount total of the liquid drug preparation and also the risk is obviated that during the withdrawal of the tip of the cannula the preparation might be injected through the upper layers of the skin also therein, i.e.intracutaneously. The thorough mixing of the constituent of the drug or preparation may also be effected in that the buzzer of the electronically controlled alarm system is coupled mechanically withthe hose sections supplying the preparation in such a manner that its vibrations are communicated to the interior of the hose or tube(Fig.90), and this shortly before the injection is carried out. The peripheral or border ring (223) at the vacuum retaining cylinder or reservoir cuplet(5) is well suited both to provide for a better attachment of the border membrane(6) and for a more adequate seal towards the injector (Fig.84).

On the field of the dose mechanism it is proposed to effect dosing by means of a magnetically clock-actuated rocker switch, if their is a correspondingly strong and resistant drug hose (e.g.made of silicone). The type of clamping hinders the feed from the container while the hose is squeezed (e.g.also within a metering screw of worm the winding of which are constricted or narrowed progressively on after the other about, the

hose, flattening off the hose(Fig.98). The possibility to let working the expansion of a body as a pressure donator (either it may be solenoid stroke of piezo-effect) in steps to a part of hose, permits as means for dosing at the same time the shutting up or locking of a afflux leg towards the hose chamber saving thus a valve (Fig.100). It was already discussed above the possibility to alter the velocity of solenoid stroke or piezo-extension (by erraticaly switching in addition of independent lamellas) and to exploit this for a commutation to an other kind of drug(Fig.97).

The flow measurement (e.g. with clocked actuation of the drug outlet valve- which may also be presented by hose ring constriction or piezoelectric shutter lamellas, to which pressure is applied, about an elastic pin in the hose in the manner of an central shutter of a photographic camera-) may be taken into consideration in connection with a critically high rate of flow or a constant drug pressure in the supply container or also the exploitation of the formation of the electrical field during flow, and this to effect to arrive at a dosing mechanism of reduced dimension. At present, the use of piezo-elements, although in its length extension well maneuvrable, seems only possible in connection with mains due to the fact that high voltage is necessary.

It may be decided, in any case, only by considerable expenditure following the prior art until this time, which composition of functional parts realizes the injector according the task or aim.

Since the application of PCT/DE85/00313 any new but essential particular perceptions and embodiments of the invention are gained which perfects it and, even, expands the scope of the invention. The experiments has shown that venous blood vessels can be sucked on the suction cup - in certain cases, p.e. if the skin extends immediately over bone-, then situated near to the upperst horny skin layers. If cannulas with long shaft are used -as it's the case in vacuum reservori cuplets (as described above)- the cannula may penetrate the blood vessel completely the insulin or drug being emptied beneath and exterior the blood vessel within the subcutaneous tissue. But if cannulas with short shaft are used, as preferable applied in full automatical and electronically controlled injectors namely as stacking cannulas, the danger of inadvertently injection into a blood vessel is irresponsible big. The control of the seat of the cannual tip by applying negative air pressure before the injection is'nt an ideal solution of this problem because the subsequent reventilation does not avoid needless blessure and, mainly, because an immense mechanical expenditure. The solution given by the new embodiments is that light (or similar rays, preferably laser) is projected through the skin knob which is elevated by suction or traction, and that the difference of light extinction is evaluated as to check wether a blood vessel is contained in the upper subcutaneous tissue under the skin or not. Preferably this is done by at least two light sources with an angle shifting of 90 degrees about the skin knob. If the light, received by the sensors of both (or more) positions is attenuated, a stop signal is generated; it reaches the reventilation valve before the tip of cannula has pierce the top of the skin knob. A warning signal may be

given by the control unit in order to repeat the injection procedure at an other place of the skin. Instead of the diascopic measurements also a reflexion measurement may be used to check the position of vessels beneath the inside of a skin knob. The other main task of this extension of the invention is concerned with the optical measurement of the skin such as the determination of its thickness as well as its density of capillary vessels or its contents of blood. Such parameters are important for a determination of the state of metabolism especially for the glucose measurement using the change of the plane of polarized light and this preferably by diascopy. The skin knob such as produced by negative air pressure inside of a suction cup or by plaster-adhsive traction or by both methodes is optimal suitable for such measurements because the raised skin is bloodless and therefore pale and transparent(likewise), for about two seconds, and than the skin lookes red by a big hyperemie for longer time. The difference of measurements during both states of the skin, this means at least two subsequent measurements, allow the calculatory determination of blood sugar. Insuch a calculation the skin thickness -equivalent to the way for the ray- and the density or respectively the number of capillary vessels can be included. This task is solved using the change of light absorption by simultaneous measurements along a type of vertically arranged light guide ledge (containing at one side equaly spaced fibre ends of detectors in relation to a light source ledge opposite) or by subsequent measurements at a few sensor points with comparation of the alterations at regular time intervals. The diaphanic measurement inside of a suction cup seems to be advantageous in such a manner as to apply also it also in connection with insulin pumps -beared on the body or implanted- perhaps with radio control without the use of a cannula inside of the suction

cup. Instead of the use of visible light also other wave lenght could be usefull (p.e. measurements by infrared light). Finally, a light source may be omitted, if temperature sensors are used to check the distance of blood vessels or the plethora or fullnes of blood by comparison of the measurement values immediately after the skin is sucked on and a few seconds after this time. By regularly photometry of thermometry the possibility is given to check the contínous skin contact and to interrupt the injection in case of an intended or unintended reventilation of the suction cup. The last described electro-optic devices or device (because all functions may be exerced by one single measuring arrangement) can be employed as a factultative supplement of a mechanically concepted suction injector as it is ameliorated for a completing demonstration of the principle of suction injection. On the field of control technic the circumstance was taken into consideration that the skin creeps comparative slowly into the suction cup. The previously described "suction switches" for launching the injection are not enabled for such injectors using cannulas with short shaft and, generally, the fixation of the pressure loading for such suction switches was difficult. In this point, the amelioration consists in a suction switch -showed as a membrane switch resuming to such a device from 1974- which communicates by a channel to an area between the outer suction cup rim and the inner sealing edge or zone. When using a limited amount of suction, as advisably with regard to the weight and dimension of the device, the raised skin leans against the inner rim or wall zone of the suction cup. On the other hand the space between the inner sealing zone (shaped elastic or large and constituing a kind of new suction rim) and the sharp outer suction rim is reventilated.

This is done through the fine wrinkles below the outer suction cup rim resulting from the traction which is exerced against the skin outside the suction cup. This reventilation after the suction phase generates a signal which the new suction switch transferes for launching the dosing device. In the field of suction production with respect to the domain of storing and freezing the negative air pressure a new embodiment consists of vacuum reservoir cuplets each having a cover fastened by a central bush letting through the cannula tip. This cover has lateral projections which abut upon inside projections of a ring which is welded with a rim of said vacuum reservoir cuplet. Inside of the suction retaining space of the injector there are triggering bars which work, in keeping with the invention, against the projections of the rotary cover causing their rotation. When the abutment of the projections is dropped the annular piston can be lifted by the influence of negative pressure. Thus the problematic and cumbersome operation of the removal of a abutting covering along a breaking line is not necessary any longer. The boundary membrane between thew outer air and the vacuum store is build by a tensil strengthened roll membrane. The locking of the piston movement by the effect of outern air pressure on said roll membrane(causing friction) is prevented by a cover membrane which can be streched and which closes the small slit between annular piston and cuplet wall. In the above mentioned prefered example of mechanical injector -developed thus from Fig.77- was returned to a self-triggering mechanism of the vacuum reservoir cuplet. The new example is exerced as a type of three-chamber cuplet which is a kind of combination between the single chamber with the twin-chamber type. Anew they are two membranes extending from the annzlar piston tó the cuplet cylinder. But the outern and abutting or

supporting membrane consists of a tensil strengthened foil p.e. made of aluminium, while the inner membrane is elastisch or easily to stretch. The central bush -surrounding the cannula tip- covers said outer membrane by its disk with a thoothed cutting edge facing to said outer membrane. Behind the latter extends the the second yielding or elastic membrane between the bush and the cylinder wall. The smallest damage or demolation of said outer membrane caused by pressure against said covering disk -even it may be a small tear at the attachment line toward the central bush- effects the raising of the bush supported by pressure of the outer air towards said yielding or elastic membrane (the latter thereby works similar as a parachute). Thereby the outer membrane is cutted open along its outer circumference by said cutting disk. The raise of the skin together with said disk may be facilitated by a skin adhesive couting of the latter. For the reventilation a new variation of mechanism is decribed by Fig.112. After the dosing movement of the dosing disk with annular wedge profile ridge or ledge has finished the spiral spring drives a cross-beam as a clearing of motion permits by a cam follower in a slot of said dosing disk. This cross-beam again drives a bush, which descends carried in three oblique slots taking with it three rods (fastened by in horizontal direction running slots of said bush and vertically guided). In such manner said three rods, equaly spaced about the outer suction cup rim, are pushed downwards touching the skin. They adjust the distance to the cannula tip while the skin is solved from its sealing seat against the inner rim or sealing zone within the suction cup reventilating the latter.

In the prefered example of Figure 112 the vacuum reservoir cuplet is taken up in a central accomo-

dating bowl as to insure the large abutting plane of the injector avoiding a repective support plate ring. For the removal of used cuplets a special dropping mechanism is affiliated, operated by a over-stroke with the help of a overtaking mechanism during rotating the adjusting ring which serves for the automatically preparation of all functions of the injector. Further means to prevent an unintentional premature reventilation by toppling over of the suction injector axis is an over beaker enveloping the injector and joint by a spring. Such an over-beaker permits (owing to the profile assimilation between injector surface and the bottom side of the over-beaker) a firmly pressing on the suction cup perpendicularly to the skin. If the manual presure is partly diminished said spring helps to separate botjh parts pf the injector. it works as a joint which prevents to manual angular movements. The same effect is caused by a spring connection between the longer upper part of the injector, serving as a grip, and a lower part mainly consisting of the suction cup.

On the field of the dosing mechanism the hose integrated pump is ameliorated and propped by a more favourable drug afflux. Instead of the uneconomical gas blowing off by a pressure relieve valve the gas, produced by joining the proper chemical components, first is introduced in a separated reservoir (p.e. the outer part of a double walled cylinder) wherefrom it passes a pres-regulating valve towards the elastic drug container. The pump, itself, has a calibrated measuring chamber surrounding case-like a spindle whose stroke closes in a first phase by solenoid or rotated profile ridged or edged disk (handling to the pierced plate or disk enlarging the hose)

the afflux towards said measuring chamber while letting open the outflow towards the cannula. This is effected by a well determined gas pressure bolster near the pump chamber und working against the outern wall of the hose. In a second stroke phase the dosing spindle is lowered. The outflow is thereby closed and the drug or preparation fills the space about the dosing spindle urgend thereby the hose wall towards the pump case, provided that the gas pressure from the drug supply container dominates the pressure of the gas bolster.In the case of the prefered mechanical inject of Figure 110 to 114 the warning and blocking mechanism against the exhaustion of the drug is also varied. The axis rod of the dosis spindle,which also serves with its acuated lower end to open the sealing membrane of the drug inlet of the vacuum reservoir cuplet, has on its upper end a button-like enlargement wherinto a accomodating bore with snap-springs engages; said bore being centrally positionded on plate of the niche of the folded bellows (serving as drugcontainer). When the drug supply is nearly exhausted the upper end of said spindle axis enters into said bore and is arrested there and this happens for all functions of the injector.

Besides, is proposed, an amelioration of the dosage hydraulic within a step syringe. Inside of the separating piston boundary to the drug at pump cycles a little dosing piston expands driven by a solenoid which is incorporated to the piston assembled parts and which is lowered while the drug is emptied in whole. The supporting piston is blocked by sidewards projecting peg (likewise operated by the solenoid) before the stroke of the little piston displaces the predetermined

dosage unit through the cannula. In a second example (Fig.116) the locking of the motion as well as the replacing of single doses is brought about by blowing up the sealing hose ring about the separating piston whith measured equal doses of an auxiliary fluid similar as in Fig.46. Because the function of blocking for the piston movement also is overtaken by said hose ring a separated supporting piston is omitted. A reflux of drug during the retraction of the little dosing piston must be avoided by a nonreturn valve. Preferably, as such serves a hoslet inside of the cannula shaft -curved to a double setting or clapped inside- which is unfolded by the drug pressure lengtheing thereby the outflow channel onto the subcutaneous tissue and the surface for the sensor coat, if any needed. Finally, the change between drugs, if only two types therefrom are provided, may by brought about by one motor in driving the one dosing pump exclusively in one direction whilst the other direction is ineffective by means of a ratched wheel and pawl. After electrically pole changing the motor runs back driving the other dosing pump while the first named dosing pump stands still, because its axis has also a ratched wheel and pawl working in the counter direction. A special change-speed gear may be unnecessary in such a manner. At this moment, the developing range is exerced of the control of metabolism using suction (or traction) against a bound skin party producing a knob and evaluating measurement data to equalize disorders of metabolism preferably by the administering of insulin by a minurized device or devices. A measuring tape gradually divided and fastened to the upper part of the folded bellows with drug may be rolled down behind a window of the cover of the injector whilst said folded bellow is lowered to empty the drug for injection.

Short Description of the Drawings (Examples) :

Figur 1 shows in a top view a filled injection syringe with sensor cannula which is connected to a measuring device.

The Figure 2 shows in the longitudinal section a vacuum reservoir cuplet which preserves negative pressure with sensor cannula connected with a dosing instrument operating by hand.

The Figure 3 shows in a side view an insulin pump connected as well with a sensor cannula as with a measuring device.

Figure 4 shows in an longitudinal section -to the rihgt hand also in the cross-section- the detail of a cannula adjusting piece which is connected with a coupling piece for the hose.

The Figure 5 gives a block diagram for the date storage and the date reading at a device according to Fig.1 to 3.

The Figure 6 gives a refinement of the block diagram of the Figure 5.

The Figure 7 shows a circuit diagram of the reader of a device according to this of Fig.5 and Fig.6.

The Figure 8 shows in a natural size the housing cylinder whith its derivating hose and the folded bellows and the supporting shell serving to the inserting cylinder in the longitudinal section except for a shortening of about 40 millimeter.

The Figure 9 reproduces the inserting cylinder which is able to be introduced into the housing cylinder of Figure 8 fournished with a maximum filled injection syringe in a logitudinal section.

The Figure 10 shows in a cross-section along the iron plate which closes upwardly the inserting cylinder whereby the position if the six permanent magnets and of the actuating tube for the reventi-

lation valve is drawn in with dotted lines.
The Figure 11 shows in the longitudinal section parts of a housing cylinder similar to this of Figure 8 whereby the features of the reventilation valve is modificated.
The Figure 12 shows diminished about to the scale 1 : 5 an water stream pump joined to the pipe in the longitudinal section sutitable to the operation of the device.
The Figure 13 shows a longitudinal section through an injector which is operated by a CO2-gas-pressure-capsule suitable for on kind of medicine with automatically change of cannulas.
The Figure 14 shows an cross-section in the Heigth of line A - B of the Fig.13.
The Figure 15 shows a cross-section in the Heigth of line C - D of the Fig.13.
The Figure 16 shows a longitudinal section through the detail of one of the both coupling valves for the liquid for Fig.13.
The Figure 17 shows a cross-section throug the yet-pump of Fig.13.
The Figure 18 shows on the left hand side in the longitudinal section and on the right in the cross-section a detail onto the end of the cannula magazine in a scale 5 : 1 for Fig.13.
The Figure 19 shows a side view towards the lid of one side refering to Fig.13; to the right of this a vertical-section and below a cross-section in the heigth of line A - B is represented.
The Figure 20 shows in the vertical-section along the line E - F of Fig.13 details of the steering for the release and the change of the dosage. Under that a cross-section is shown.
Figure 21 shows in the scale 2 : 1 details

of the Fig.20. Under that shown again a cross-section along A - C. At right hand details of the position of the overcoming spring of the trigger is perceptible with two views which are turned for about 90 °.

The Figure 22 shows ina partial view above and belove in the longitudinal section an in the middle in the cross-sections A - B and C - D details of the steering mechanism.

The Figure 23 shows the steering arms, which extend from the half-conduit and the lid slides, which are operated from these, with counter and blocking mechanism in a partial diagram in the longitudinal section and under said in a over-view. To the right hand yet a vertical section is demonstrated.

The Figure 24 shows in the longitudinal section the counting and blocking mechanism according the Fig.13 and the following.

Under said lies the cross-section in the hight A - B.

The Figure 25 shows in a scale 5 : 1 the detail of the transposition of the stroke-moving of the counting mechanism to the turning.

The Figure 26 reproduces in a winding up with the scale 5 : 1 the grooves inside of the guiding-bush.

The Figure 27 reproduces on the left in a longitudinal section and on the right of said in the longitudinal section also in a scale 5 : 1 a cannula magazine and variations of stack-cannulas.

The Figure 28 shows in a scale 10 : 1 on the left in a longitudinal section and on the right in two cross-sections of different hight a dose pump for the auxiliary liquid.

The Figures 29 shows in the longitudinal section an electrically driven injector with syringes for multiple use for two different medicines.
The Figure 30 shows a cross-section of the Fig.29 in the hight A - B.
The Figure 32 shows a wiring diagram in TTL according Fig.29,30.
The Figure 31 shows in the longitudinal a variante according to Fig.29, which have a motor with a control gear for two dosing hose pumps.
The Figure 33 gives a TTL-wiring diagram of the Fig.32.
The Figure 34 shows a medicine suppley bottle with pressure gaz inside of a folded bellows in the longitudinal section.
The Figure 35 shows in a longitudinal section through a medicine sac inside of a sac with pressurized gaz.
The Figure 36 a schematical over-view of a suction injector as a prefered elaboration of the invention. Inside of the magazine hose the stooring of stack-cannulas of two different constructions is presented in the longitudinal section.
The Figure 37 shows a longitudinal section through the suction injector, which follows to the line F - G of Figure 36.
Over the suction cup a cross-section through said (the hight signed by an auxiliary line) and is perceptible and on the right a cross-section downwards from the suction piston.
The Figure 38 shows a over-view to the roof of the suction cup and additionaly the cylinder(304) with the cannula magazine.
The Figure 40 shows a schematical longitudinal section along the line C - D to explain the mecnaism of piston-guidance and of the movement of the suction cup lid during the waiting position

before the injection.
The Figure 41 corresponds sweepingly to the Fig.40, but it shows the stage after the injection.
The Figure 42 shows the stage after the closing of the lid.
The Figure 43 shows a variation of the trigger mechanism for the suction piston whereby the line of the longitudinal section follows to such of the Fig.26; the suction cup is presented in a side-view.
The Figure 44 shows in a schematical longitudinal section a possibility of connection between the old and the new suppley sac for the partial fillingup of the old.
The Figure 45 shows above in the longitudinal section and below in the cross-section two dosing pumps for the injector as in Fig.26 and following and a bolting device of the supply bags.
The Figure 46 shows in the longitudinal section in the scale 5 : 1 the detail of a dosing pump in connection with one of the magnetic driven dose pumps.
The Figure 47 shows schematically the running up of a peristaltic dosing movement on a variation of the arrangement of the pumps to saving dose pumps.
The Figure 48 shows in a longitudinal section in the scale 5 : 1 a stack-cannula according the Fig.25.
The Figure 49 relates sweepingly to the Fig.48 and is a variation of cannula.
The Figure 50 shows in a longitudinal section and under said in a cross-section along the line A - B in the scale 5 : 1 a special sensor cannula in wich the shaft is partialy replaced by plastic material.
The Figure 51 shows a cannula with a inlayed sensor tube or sensor thread while the shaft is intact which cannula relates according to the description

to the Fig.50.

The Figure 52 shows a variation of a cannula with inner coating in the longitudinal section and in the scale 5 : 1 .

The Figure 53 shows a cannula, which corresponds according the manner of representation, to the Figure 50, whereby a little hose is put in the cleft shaft.

The Figure 54 shows in the longitudinal section in the scale 10 : 1 a sensor cannula for the reflexive photometrical measurement.

The Figure 55 shows in the longitudinal section in the scale 10 : 1 a sensor cannula for optical measurements with light conducting fibres, shown only as far as the shaft attachment.

The Figure 56 shows in the longitudinal section in the scale 10 : 1 the variation of a stack cannula coressponding to Fig.48,49 inside of a boring of the device, whereby the light is feeded by a swivel segment.

The Figure 57 shows above in the longitudinal section and above in the cross-section the arrangement of the rotary contactor rings on a cylinder of the device for a contrivance according to the Figures 36 and the following.

The Figure 58 shows a functional diagram for an electrical dontrol and programming.

The Figure 59 shows a program operation which is controlled by a processor for an injector according Fig.36 and following.

The Figure 60 gives a afinement of block 6 from Figure 59.

The Figure 61 is a continuation of the Fig.61.

The Figure 62 is a continuation of the Fig.61.

The Figure 63 is a continuation of the Fig.62.

The Figure 64 is a continuation of the Fig.63.

The Figure 65 is an illustration of an embodiment of an injector having two parallel and

identically operated hose or tube pumps as dosage device and comprising a supply bag having highly flexible walls and a vacuum reservoir cuplet of the twin-chamber type as vacuum source; this embodiment together shown in a longitudinal sectional view.

The Figure 66 is a cross-sectional view of the mechanism(A - C) of Fig.65, showing dossage preselection for three respective applications.

The Figure 67 is a cross section C - D of Fig.65, showing the dosis counter with locking means.

The Figure 68 is vertical section E - F of Fig.65, showing the release mechanism for reventilation and for dosage dispensation subsequent to the termination of the vibratory operation.

The Figure 69 is a cross-sectional view G - H through the upper region of the vacuum reservoir cuplet of Fig.65 with the mechanism for holding the latter in the injector as well as a mechanism not represented in Fig.65 for removing the same.

The Figure 70 is a cross section J - K of Fig.65 of the mechanism for the release of the vibrator means as well as the release mechanism for the reventilation by means of spring-actuated mandril or pin.

The Figure 71 is a simplified cross-sectional view I - M through Fig.65, showing the dosage pump arrangement. It shows, below, a cross section for illustrating the embedding of the hose or tube in the supporting discs of the roller axes in the direction of the arrows.

The Figure 72 is a schematic view of a rolled-up projection along the plan view O - P of Fig.65 of the vibrator.

The Figure 72 is an enlarged view on the scale 2 : 1 of a cross-sectional view through an alternative embodiment of the pump arrangement with

respect to Fig.65 with four roller pairs jamming respectively one of both tubes or hoses between one another.

The Figure 74 is a schematically rolled-up plan view in the direction of the arrows of Fig.73 at a normal or natural scale, wherein the guidance of the hoses is readily seen.

The Figure 75 is a highly schematical longitudinal section showing an alternative embodiment of the release mechanism for the vibrator means, and the upper part of a vacuum reservoir cuplet.

The Figure 76 is a highly schematized representation of the four functions stage A to D of a mechanism for the reventilation by means of sliding valves.

The Figure 77 is a longitudinal section through the injector with a dosage device integrated within the hose in the manner of a piston-cylinder pump, a screw cover with a mechanism for automatically scaling down the drug or preparation supply container, and a suction cup rim with elastic lips, which is associatied with the injector, as wellas a release device for the bottom cylinder of a vacuum reservoir cuplet, which device assumes the holding or retention function of support means for the cuplet proper to be removed prior to the use of the injector.

The Figure 78 is a view in cross section A - B of Fig.77 of the locking mechanism.

The Figure 79 shows a rolled-up projection of Fig.78 in a schematical longitudinal section.

The Figure 80 is a schematic view representing the two functional stages A, B in Fig.77 of a mechanism for the reventilations by means of a sliding valve.

The Figure 81 is a view in longitudinal section of an injector with a solenoid-operated tube-integrated pump similar to the one shown in Fig.77, wherein a roll or reel of sheet foil as-

sures a uniform feed or advance of the drug or perparation as carrier of chemicals for the gradual generation of pressure gas in connection with a pressure control valve, and wherein a device is provided for thermally generating the negative pressure or vacuum for the suction cup within three separtely activatable storage or reservoir chambers.

The Figure 82 is a cross section taken in the direction C - D through the vacuum reservoir chambers and the suction cup of Fig.81.

The Figure 83 is a partial schematic rolled-up projection of the mechanism for opening the flap valves to the vacuum chambers.

To the left of said Fig.83 is a schematic rolled up view of the course of the grooves for the cam of the feed cylinder of Fig.81 so as to explain the sectoral rotation thereof after lowering the drug or preparation container towards the pump housing.

There below(III) the release function is explained in a cross-sectional view A - B to Fig.82.

The Figure 84 is an illustration of a modified embodiment of a vacuum reservoir cuplet similar to the one shown in Fig.77.

On the left half of said Figure the transverse slot can be seen wherein the bottom cover is locked;

in the right half of said Figure is seen, after removal of the latter, the stop of the annular piston through a locking lamella of the injector.

The Figure 85 shows a schematic cross-sectional view through the suction cup collar of an injector, wherein a clover-like lobed cross section can be seen with the release pins being located outside of the suction cup.

Figure 86 is a longitudinal section showing a vacuum reservoir cuplet of the single chamber type with a removable covering of the suction cup in conjunction with an illustration of a locking mechanism for the draw-pull or plug-in cylinder supporting the bottom ring and being associated with the injector, while also showing a device for controlling the seat of the cannula with regard to the contact of the blood vessels.

The Figure 87 is a schematic view of the various steps of the method for producing a vacuum reservoir cuplet in keeping with Fig.85.

The Figure 88 is a view of a vacuum reservoir cuplet of the type used in Fig.65 within the conductor cylinder in the stage wherein, in longitudinal section, the skin has been raised by way of an equalization of air pressure.

The Figure 89 is a schematic lingitudinal projection at a scale of 3 : 1 of both of the sectional ridges facing one another for deflecting the valve rod in the injector of Fig.77.

The Figure 90 is a schematic longitudinal section of an holding angle as connection means between an electromagnetic buzzer and a ring arround of a dose pump as mechanism to mix the drug components.

The Figure 91 is a longitudinal section of a medicine-containing folded bellows, which is exhausted through a hose with therein integrated pump without a separated pump housing.

The Figure 92 is a simplified electronic principle-set-up for the injection by means of a device as represented in Fig.81.

The Figure 93 is a kind of electronic flow chart for the computer controlled indication of the consumption of the medicine stopck, the alert signal just before imminent supply exhaustion, and for locking the operation or functions of the injector so as not to dispense when there is an insufficient residual amount of medicine as in Figures 81 and 82.

The Figure 94 shows in the longitudinal section a lock-up device of the medicine supply until that supply is exhausted.

The Figure 95 shows in the longitudinal section a variant of the hydraulic dosage.

The Figure 96 brings below a plan view and above a loingitudinal section along to the section line A - B of a dose mechanism, wich is stroked by pressure of a solenoid.

The Figure 97 brings in the longitudinal section a worm-formed dose mechanism similar to that one of Fig.96.

The Figure 98 shows in the longitudinal section a dose mechanism.

The Figure 99 shows in the cross section a hose throttle which is connected to a electronic flow-through measurement.

The Figure 100 shows in the longitudinal section a dose-change by means of a change gear, what means a dose mechanism for two drugs by means of an single motor.

The Figure 101 -also shown in the longitudinal section- performs the same task by means of different attractive velocities of a piezo-pressure conductor.

The Figure 102 shows in the longitudinal section the motion of the cannula magazine towardly and backwardly the skin by means of suction in a two

functional stages.

The Figure 103 shows in the longitudinal section two functional stages of an injection by means of the raising up of the skin by plaster-traction.

The Figure 104 shows the polarized-photometric control of metabolism through the knob of the skin which is raised up into a suction cup.

The Figure 105 shows the basic experiment relating to the influence of the conductivity of a membrane with sepharose-concanavallin A by glucose.

Figure 106 shows in a schematical longitudinal section a photometric measuring arrangement about the suction cup using a light sources and sensors bearing ledges; at the left hand side the skin is raising, at the right it's already raised. A ray absorption graph is shown; the measuring events simultaneously.

Figure 107 shows a device similar to said of Fig.106 with two measuring rays wherein a subsequent measurements are used.

Figure 108 shows in a schematical cross-section a measuring arrangement similar to said of Fig.107; the ferretting out of blood vessels is demonstrated.

Figure 109 is similar to Fig.108; additonally a thermography and a reflex photometry is shown.

Figure 110 is a partial schematical cross-section through a skin knob inside of a suction cup with a diaphanic measuring arrangement.

Figure 111 is a principal set up of the use of a measuring arrangement as in Fig.110 combined with a such as in Fig.107.

Figure 112 is a longitudinal section of a mechanical suction injection as a type simmilar to Fig.70 but with essential new embodiments.

Figure 113 is a schematical cross section along line A - B of the Figure 112.

Figure 114 is a other schematical cross-section along line B - C of Fig.112.

Figure 115 shows at a scale 1 : 5 an injector consisting of two parts, namely a grip and the suction cup connected by a spring to permit angle shifting movements during the injection. A schematical longitudinal section is shown.

Figure 116 is a such respective to Fig.115, but the same task is solved with a kind of spring resilient over beaker.

Figure 117 shows a cannula with a hoslet inside of its shaft, which is bent over; during the injection this hoslet can unfold and prolongs the cannula shaft. This is done at a scale 5 : 1 and a longitudinal section.

Figure 118 shows a cannula similar to them of Fig.115, wherein the hoslet is turned the inside out.

Figure 119 is a third kind of cannula with very elastic hoslet, which can be stretched.

Figure 120 shows in a longitudinal section a type of dosage hydraulic using a step syringe similar to said of Fig.95; but an apply of auxiliary fluid from outside is avoided thereby.

Figure 121 shows a variation of the device of Fig. 118.

Figure 122 is a type of vaccum reservoir couplet with a release mechanism operated by a tripping mechanism of the suction injector; a schematical longitudinal section is choiced.

Detailed Description of the Drawings(Examples):

Figure 1 is a plan view of a filled hypodermic or injection syringe(233) with a clamp(227) mounted thereon and from which contacting terminals(228) issue which are placed on the sensor coat of the cannula(326).

Over that a cross section having the scale 2:1 shows the seat of the contact terminals about the shaft of the cannula. From these contact terminals the conducting line(234) leads to the housing comprising the measurement device (288) as well as the reader(289) with its printer. The cable(240) connects the measuring device to the contacting plaster(228) for the skin, which plaster functions as comparison electrode. After the cannula has been introduced under the skin and after the lapse of a certain period of time, the measured value can be read.

Figure 2 is a view of a device similar to the one shown in Fig.1. However, the injection cannula(326) with the sensor coat is deposed here within the reservoir cuplet preserving the vacuum (as has already been disclosed in the Canadian Patent No 1 189 412 of June 25th 1985 in Fig.3 and 4 and in the laid-out document O 103 664 of the European patent application. The conductors(234), encased when manufactured, in contact with the cannula coat lead to the socket(235) in the cover. The valve pin(229) is located within its guide tube(230) placed in the center of the reservoir cuplet(In this case when of elliptical form in one of its centers). It is provided as inventive improvment with a leaf spring(231) supported on the suction cup rim. This spring is shaped in a convex arc to-

wards the skin and attached in the center by a valve pin, the tip-shaped end of which is spaced from the stretchable cover sheeting or foil(232). The cannula is located adjacent to the valve, but not in projection to the leaf spring. The contacting plaster has been replaced here by the adhesive electrode(239) on the suction cup rim, which electrode has its proper encased lead(236) to the jack. Before carrying out the injection, the plug-in nipples of the lead(236) and of the cable(240) towards the measuring instrument(388) are inserted into the jacks(235). The injection syringe(233), filled up in an usual manner, is sticked up onto the cannula attachment piece, the protective foil or sheeting ring(237) is withdrawn from the suction cup rim prior to use. If the reservoir cuplet subsequently is pressed against the skin to prepare the injection, so the valve pin is raised. The leaf spring takes on tension and, finally, turns upwards whereby its ends leave the suction cup rim. Thereby the valve pin is shot explosion-like upwardly and pierces with its tip the covering foil (after it was stretched out) causing the equalization of air pressure and the raising of the skin. (The stretching of the cover sheeting or foil hinders that the opening of the valve takes place before the suction cup rim is firmly closed by the skin). The protective foil or sheeting ring(237) is withdrawn form the suction cup rim prior to use. The measuring instrument(288) may also preferably be supported on a resilient jointed-band(241) and the adhesive electrode may then be replaced by contact pads underneath the measuring instrument. The dosing device comprises, similar to those shown in Figures 71 or 82 a pump to be clock-actuated by exerting pressure on the grip

strip(180). That pump is fitted on the hose(44) and is fixed by the container cylinder(19) with slotted walls by means of the screwing(578). The drug containing folded bellows(731) is fastened on the container cylinder by means of an attachment ring(579). Said attachment ring serves to the pressure spring as a counterseat to remove the rod(110) and to effect thereby the drug ejection. After the reservoir cuplet sticks to the skin, the result of the measurement will soon appear and a corrected dosis, as determined by the computer, can then be dispensed in a clock-actuated manner.

The Figure 3 illustrates the combination of the sensor and dosage compensation means (equivalent to the computer) comprising a custromary insulin infusion pump(245). Incorporated in and with the housing of the infusion pump is the measuring instrument(288) as comprised of the dosis compensation device(288) consisting also of the reader (289) and the computer(246). The conducting wires (234) connected to the components of the sensor cannula are insulated and guided, over a certain distance, within the wall of the feed hose(236). Further down they have their own insulation and are connected to the jacks(235) in the housing of the control unit(175).

The Figure 4 shows in the longitudinal section and on the right the cross-sectional detail of a cannula attachment piece in connection with a hose coupling piece. The cannula attachment piece(47) comes near to contact with the plug-cone(570) of the feed hose(236). The holding clamp with the sliding contact(254) insides is not yet engaged into the grcove(581) towards

the cannula wherefrom contact is produced through the little wire(577) with the cannula shaft. From the sleeding contact the cable(240) leads, over a certain distance, within the wall of the feed hose insolated to the measuring instrument. From the sensor coat another little wire leads through the cannula shaft to the inner contact(253) which is within the boring of the cannula attachment piece. There this touches with the conductable surface of the plug-in cone and on such a way over the conductive wire(234) with the measuring instrument.
The arangment of Fig.3 comprises most suitably also a measured-value memory or storage so as to allow displying on a screen or reproductive device(255) all numerical data -possible expressed as curves- expressing the response of the measured-values at low dead load for the patient, which data are thus readily available to the physician.

The Figure 5 represents a principle set up of such a device. The hardware for this comprises a processor controlled system for storing measured quantities, to evaluete them while paying due attention to eigenindicators and master parameters of the system (without instruction from without). The essential part of the system is the CPU. As store for the firmware of the system of operation useis made of EPROM/ROM, for filing non-volatile yet variable data (e.g. master or routine parameters) use is made of RAM as intermediate quantity storage.

The Figure 7 shows the principle circuity which is capable in storing measured quantities

or values at regular temporal intervals (e.g. of 15 minutes), which quantities are read out by a procesor system equipped with the appropiate interface.

A.Recording the measured quantities: In the last reading of the measured quantities all stores and adress counters will be reset to "zero". The first timer pulse write the actual measured quantity into the storage location or cell of the address(ØØØ) and raises the adress counter for the clocked input by one. The second timer puls repeats this procedure with the next addresse(ØØ1) and so forth.

B. Reading the measured quantities: Via the interface the state of the enabling circuit is modified with the consequence that the AD transducer is separated from the data bus and the timer is set at rest. Now, after initiating "Reset" via the data bus the storage contents can be read by count-up of the adress counter. The data word or item(ØØ) is used as end of recorded information. Subsequent to the read operation the initial state as described under A must then be restituted.

Figure 8 shows in a natural size exept for a shortening of about 40 millimeter the housing cylinder with the drain hose and the folded bellows and the taking up socket for the inserting cylinder in the longitudinal section. The device is principaly suitable for the operation by means of a permanent suction source. As such may serve water stream pumps or vacuum cleaners. The housing cylinder(701) with the basic ring(702) carries the tube socket(703) with the bayonet

guiding groove(704) which serves to fasten the inserting cylinder(Fig.9). The folded bellows(705) tightly screwed with the basic ring(702) by the holding ring(706) and this is screwed by the fastening ring(707) with the piston(708) whereby its guiding shell(709) prevents from squaring. Inside of the central boring of the piston(708) deemed in a loose gliding seat the sliding tube(710) which is tightened to the tent-like membrane(711) by screwing. The shifting tube(710) continues above into the drain hose(713) which lies, in spirals owing to the tension made in advance, below of the lid cap(714) and leaves this through the fastening sleeve(715) toward a water stream pump or toward another suction source. The carrier ring(716) for the permanent magnetic pegs(718) which are magneticly closed together above by the iron ring(718) is fastened to the piston(708) by the srew-pegs(719). Through its central boring the carrier ring(716) lets pass the shifting tube the end of which is sloted to let pass air easier. Through a peripher boring passes the trigger tube(721) likewise in a sliding seat for the sealing valve stem which slides as an octagon square to facilitate air passage in the valve boring with lid weakly biased by a pressure spring. The channel(722) leads out of the valve boring sidewards toward a slot of the guiding shell(709) which is open upwards to let in the outern air throught the cap bore(722).

Figure 9 shows in the longitudinal section the inserting cylinder(724) with a slope for the sealing(725) and the both bayonet pegs(726) and the opening of the suction cup towards below. Inside of the inserting shell or cylin-

der with an upwards club-like thickeness the shifting shell(26) is arranged which is pressed by the weak pressure spring(729) against the iron plate(730) sticked up to the inserting shell and which thereby holds the syringe(233) on his flange upwards. The covering lid(732) for the suction cup which is often dispensable subsists by rubber elastic material whilst the other parts - except for the shifting tube(710) and the trigger tube(721) which may be also metallic- are produced suitably by acetate plastic or Delrin or similar material. Slide contact(254) into the inserting cylinder is adjusted towards the cannula shaft, an contact spring(576) is adjusted towards the canula attachment piece of a proper sensor cannula connected to contacts.(Instead of the conductive coat of the plug cone(570) as in Fig.4) the surface of the cannula attachment piece is conductively therefore) the wire (234) and the cable(240) joint the injector with the measuring instrument.

To prepare the injection the syringe will be filled from a flask in an usual manner than fournished with a sensor cannula and introduced into the opening of the inserting cylinder in such a manner that the flange of the syringe cylinder passes through the oval boring(see Fig.10) of the iron plate. Answering the purpose- in particular if the inserting cylinder for syringe will be introduced into the tube socket(703) the syringe stem pointing downwards- the syringe is turnded over perhaps 45 ° by its stem to avoid that it falls out. During the fastening inside of the tube socket(703) by turning of the inserting cylinder until the bayonet pegs are blocked the sealing(725) is pressed against the bottom or basic ring(702) and works therefore between the housing cylinder and the insertion cyder. Suitable an eventual store is effected in-

side of a clean linen. The suction injector at best is connected constandly with a permanent suction source for example with a water stream pump as described in Figure 12.

For this purpose a conically amplified end of a water hose is shortened as far as it can be shoved up tightly to this part of water-tap which is at hand in the household with the outlet opening who it is able to be sqeezed firmly by a band clamp(738) which bears the holding arm(739). This again shows the axis(740) toward the jaws which may be fixed by means of a thumb screw. Into this jaws the tube(743) of the water stream pump may be shoved and squeezed fixed with the thumb screw(742). Because the mouth of this stream pump may be straightened into any direction and the water stream before is guided through an eddy mechanism the tap is easy to use, whereby at a time air is sucked on over the socket (745) with the drain hose(713). For the purpose to inject the patient has to take the injector out from the linen which clings to a hook or lies on a place of deposit and has to straighten the suction cup toward any body partie(so far as it proves to be not unsuitable for the injection by its sensivity and its nature as skull partie or anus or soles or palm) after he has opened the tap and thereby has activated the stream pump according to the arrangement of the Fig.12. At first than the skin is elevated into the suction cup by suction and fastened there, then the membrane(711) with the easily working sliding tube(710) is sunk and finally the piston(708) with the folded bellows(705) and therby at first the injection syringe(233) is pressed against the pressure spring(229). After the shifting shelf(728) is stopped on the botom of the insertion cylinder(724) and the cannula is entered into the highly drawn skin the syringe stem is

sunk until this stop and the syringe is emptied. During the last millimeters of the distance covered by the carrier ring(708) which is taken along with the piston(708) its magnetic pegs are attracted by the iron plate(730) which facilitates the triggering tube(721) to be elevated and which thereby facilitates the reventilation valve to be opened, so that the outern air may enter through the canal(722) which causes the syringe to be elevated by the pressure spring(729) because the vacuum below the membrane (711) is suspended, while the skin is withdrawn out from the suction cup and while the folded bellows with the piston(708) further remaines held fast by magnetic power. The patient is able to ascertain while the housing cylinder(701) is transparent or by the longitudinal slot(733) if needed by feeling with the finger before the device is deposited. If the srewing of the inserting cylinder(724) is loosened in the bayonet grooves while the pegs(720) are turned back, so the iron plate(730) removes from the magnetic pegs and the folded bellows expands again by its own elasticity and the return valve is closed by its pressure spring. It may be yet supplemented the pressing peg (574) which is attached on the shifting shell(728) and which, while said sinks, pushes against the contact spring(574) and approaches them to the cannula shaft. On such a manner is avoided the pollution of that area of the cannula which later enters into the skin.

In Figure 11 a part of the device is demonstrated similar to this of the Figures 8 to 10 which shows a variation of the reventilation valve and the automatically operating of them. The housing cylinder (701) is saparated in a upper and a lower part by a blank(746) with obliquity of wall wich are held together by the fitting bush(747). The piston(708)

is connected with the folded bellows(705) and contains in its central boring the sliding tube(710) which upwardly shows a notch and the inner lumen of which towards above continues in a little folded bellows(749). This again continues in the drain hose (713) which is sealed by the fastening bush(715) in covering lid(749). In a transversal boring of the piston(708) two pegs with rounded tops are shiftable mounted thouse elastic sealing caps(751) are able to uncover the borders insids of the borings(752) towards the entrance into the smaller borings(753). Out of the smaller borings(753) channels(722) for the reventilations leads upwards. The lower end of the sliding tube(710) is amplified and lengthened to a pot(754). If the folded bellows(705) is detented the little folded bellows(799) extends, the pegs lie over the obliquity of wall of the blank(746) inside of the depth of the notch(748) shifted insidwards during the raising and the sealing caps(751) tightly are pressed onto the little borings. By the working of suction the piston(708) can be sunk after the suction cup is closed by the skin; after the pot(754) has touched the cover lid(30) of the inserting cylinder it is lifted and also the sliding tube(710), whereby the obliquity of the notch(748) the pegs shoves outwards which happens even during the stadium at which the piston sinks during their ends are able to make away for the blank(746) of the housing cylinder, by which the piston is avoided to be elevated so long as the sliding tube(710) is able to make away for below after the inserting cylinder is removed, promoted by the elasticity of the little folded bellows(799). The moment of the turning away and outwards of the pegs(750) during the piston has its lowest level, is also that in which the elasticity is overtaxed, so that its borders are teared off from its seat before the en-

trance of the little borings(753). By this means the air-stream is released in the rear of the piston onto the interior of the folded bellows (705) for the reventilation.

Figure 13 is a longitudinal section of an injector device, wherein the vacuum for the suction cup(51) is generated by means of a CO_2 pressure gas capsule via the gas jet pump(257), which vacuum is preserved there by way of the pressure control or relief valve. Relief of the compressed gas takes place via mandrel(258) with groove, which mandrel is fixedly and tightly screwed to the valve block (258). Two coupling valve follow the valve block downward from the bridge(260), thereafter a control shaft with cannula magazine(262), a front and rear dosing spindle, respectively, with threadings for the associated dosing nuts(164) -as can be seen in the Fig.14 in the cross sectional view-, slide valve(265) and slidable pump housing(111) for the dosage piston stationarily held on a bar. All component parts mentioned as far, and others, belong to the device equipment to be reused, while the housing of the plug-in unit to be thrown away contains the CO_2 pressure gas capsule(256) above the - sieve-like perforated- accomodating tube(269) for the swelling pin, the elastic bag(271) with the auciliary fluid, and the step syringe cylinder(272) made from silicone coated glas. This latter terminates on the top in the valve tube(273), whereabove the shiftable collar(274) is mounted. The separating piston(275) between drug and auxiliary fluid is provided with an envelope of wax (276) and terminates in the hook-shaped discharge tube(277) branching off laterally and reaching from below into a bore of the cannula magazine (316). The plug-in unit and the device or equip-

ment part are bolted one to another by means of an attachment spindle(279). For tightening the square check or binding nut(280) the resilient ring(281) is used, which can be acted upon by the pipe socket (282) with its hinge or joint(322) by means of rotating the arm(342) with its joint or hinge(322) for the suction cup cover(342). The angle or wall bracket(283) is used for locking the dosing pump. Said bracket comprises power transmission between the locking ledge(283) in the control shaft and the sliding cylinder(285) being slidable over the cylinder of the pump housing against the compression springs(284), which sliding cylinder(285) is guided in the external cylinder(286). About a longitudinal axis the wedge(287) for the dosis change is pivoted in notches of the locking ledge, and also the holding slot for the tensioning loop(288). The cannula tube(289) being, behind the lip seal (290), extended or enlarged in the form of a pipe is made to contact the end of the used cannula by means of the holding arms or brackets when closing the cover. In the upper part one can see the compression spring(291) for the cover sliding head (292) as well as the accomodating sleeve(293) for the bag(430) filled with auxiliary fluid. From the gas channel the cross channel(294) is seen behind the sluice valve -which is described in greater detail in Fig.19. This channel(294), behind the locking ball of the nonreturn valve(295), is connected via the channel(296) through the cannula (297) within a plug membrane in the housing(229) to the gas reservoir(429) of the plug-in unit. The channel(299) is connected via the nonreturn valve(298), extending via a jet or nozzle into the hose connection(431) up to the end of the cannula magazine and arranged parallel to the nonreturn valve(295), to the gas jet pump.

Figure 14 shows a partial cross section through an injector of the Fig.13 along to the section plane A - B there. The elliptical suction cup(51) with the central pin(433) and the cannula magazine(316) in the interior, likewise the step syringe cylinder(272),
the outside cylinder of the dosing pump for the auxiliary fluid, the dosing spindles(263) with dosing nuts(264) and the locking ledge(283).

Figure 15 shows in the cross section along line A - B of the Fig.19 the sliding head(292) of the cover with its pressure spring(291) and the bolt or pin(449) of the flap hinge. Moreover, the U-bent of the transversally extending cannula magazine(316) has been rendered visible.

Figure 16 shows in the longitudinal section a fluid coupling device whereby the plug-in is approaching to the cover bridge. To the fluid outlet opening(442) on the accomodating cylinder ventilated in the top, closed by the resilient sliding sleeve(444), corresponds to the fluid inlet(262) in the valve tube(273) of the step syringe cylinder (272), which aperture is closed by the sliding collar(274) and will first be displaced when the shoulder of the accomodating cylinder will approach the aperture or opening, whereby the cover of the valve tube will, additionally, displace the sliding sleeve(444).

Figure 17 shows in a cross-sectional view the gas jet pump(257) with the gas adflux channel(446) and stub leading towards the suction cup, and the the suction or vacuum retaining nonreturn valve(448).

Figure 18 is a drawing on a scale 2 : 1 showing on the right side in longitudinal section the cannula exchange mechanism. The snap-in ball (432) is urged by the central pin(433) in its bore(434) within the accomodating cone(435) for the housing(575) of the plug-in unit through a lateral slot in the cannula magazine into the central notch(436) of the cannula body. The latter can be descended via gas pressure, having for a short time accumulated behind the cannula magazine, first at that instant when the central pin has been lifted up completely. In this connection, the lateral flattened portion(437) thereof allows the snap-in ball to recede from the cannula. The cannula descends up to the resilient locking pawl(438). If the central pin descends once more, it will again displace the snap-in ball because it can evade into the upper notch of the lower cannula and in the lower notch of the upper cannula. If the contactor pin(356) in the cover actuates the pawl, the cannula may be taken over by the lip seal into the accumulator tube of the cannula. Since a slight lift of the central pin permits, when closing cover, the snap-in ball to pass a gap in the central pin, the subsequent cannula steps further downward. The small channel(439) in the body of the cannula registers in the position thereof on the pawl with the drug output opening(440) from the step syringe. The illustration to the left in the cross sectional view shows the oval configuration of the cannula and cannula magazine as well as the lip seal above the snap mechanism of the central pin, as described.

Figure 19 is a surface longitudinal section of showing the flap hinges with the flaps of the

front(shown in dashed lines). In the center of theflap a rectangular slot(452) has been left free for the clearance of the dosing nut.
In a plane far to the rear one can see to the left the "sluice" valve. The gas channel(294) from the CO_2 pressure gas capsule connects to the compressed air chamber(455) closed by the large valve disk or head(456). In its central bore a smal valve cone sits on the narrowly terminating pin in front of the abutment plate(457). The pin is ground in the slide valve cylinder(458), extends therein, and is provided with an annular (tee-) slot. In the slide valve cylinder the gas is laterally fed from the high-pressure chamber and is, then, subsequent to the flap pin(461) having descended under the influence of the wedge slant of the slide(461), conveyed further to the cross channel via said annular slot or groove. Prior thereto, after ejecting the small valve cone, gas banked up or accumulated in the pressure chamber with the slide valve being still closed, which permitted ejection of the large valve disk by means of the abutment or pressure plate.
To the right under II in the vertical section along line A - B pf the longitudinal section one can see closed flaps(445) comprising the flap hinges(450), and the contacting support arms(463), the left whereof supporting the bolt or pin(449). To the left the opened flap is illustrated in dashed lines.
Under III the left flap can be seen in plan view on the level of the slot(452) with the dosing nut.
Therebelow under IV a cross section is shown within the cover bridge. One can clearly seen the influence of the cover sliding head(292), above its wedge slant(464) by means of its pin or bolt (449).

Figure 20 is a vertical section across the control shaft, wherein both of the dosing spindles (263) with their dosing nuts(264), the attachment tng or hinge(465) for the axis(466) of the wedge (287) for changing the dosing, the burling- or nap-type spring in its connecting link guide(72). Therebelow the resilient pin is shown for manually switching over between the adjusted dosages. the tripping or release means(469) is provided with a profile nose(470) for engaging the snap-in notch of the locking ledge against which it is pressed by means of the leaf spring(471), while being rotable about its axis(472). To the right the restoring spring(472) of the pins(468) supporting the snap-type springs are illustrated, being guarded against rotation by the guide pin (471) sliding in said slot. Ther carrier plate, on the right control shaft above the suction cup, transmits the movement of the central pin(433) to the semi-groove(475) adjacent the outer cylinder and subdivided into two legs and from there to the cover slides. Therebelow the link(476) adjustable in hight relative to the central pin is shown for mounting the dosing spindles(263) safeguarded against rotation.
The partial cross section below Fig.20 gives an even clearer illustration of the position of the component parts.

Figure 21 is a view on the scale 2: 1 showing the release means for the fluid injection in greater detail. The profile nose of stud(470) on a projection of the locking ledge(283) is shown in cross section in the lower part thereof.
In longitudinal section the overrunning spring (477) is shown in the upper part thereof, which spring slidingly abuts the fork-typ aperture

(as shown to the right in the direction of arrow A). The release or tripping slide(484) on the end of the central pin causes, when lifting its upper wedge slants against the overraunning spring, the turning off motion or deflection of the trip means(485). It engages with its fork the notch(485) due to the influence of a leaf spring (471). Once the central pin returns, subsequent to injection, while being directed towards the skin, the upper slant or obliquity ot the notch (485) slides the overrunning spring backward, and the tripping slide is enable, within the fork opening(483), to overtake the tripping means.

Figure 22 is a transversal section through the control shaft -forming the intermediate space between the plug-in unit and the dosing pump- above the tripping means on a scale 2 : 1 , showing the mechanism for the dosing stage selection. It is readily seen that the pin(468) for the altering the dosing can be lifted with its bearing bush on the locking ledge(283), while the counter pin(499) remains stationary with its powerful compression spring. On the cross pin(501) it can be descended in the guideway of the wall slot(500). The pin(468) is advanced downward under the effect of its spring, and the nap-type spring effects, by way of its progress within the connecting link guide(72) of the contactor or tripping calinder(which is shown to the left), an axial pivot of the tripping cylinder and, hence, also of the wedge attached thereto and bent thereon, for the dosing operation. Thus, it is possible to carry out the change as to the selection of the dosing stages without triggering the dosing operation.

Ther cross sectional view therebelow shows the angular displacement between tripping cylinder

and the wedge(287) as well as its position above the dosing nut(254). The wedge position in dashed lines illustrates its position subsequent to switch-over.

Figure 23 is a view of the control arms issuing from the semi-groove, and the cover slides thereof with the counter and locking device in a partial longitudinal section as well as in the central view in cross section and, once more, therebelow in a plan view. To the right there is shown, additionally, a transversal section.
The end roller(486) of the control arm of the central pin acts, when being lifted, on the wedge slant of the slide, while moving ist to the left. The snasp-in pin(488) thereoff takes the valve opening slide along with it by frictional-type locking, which slide descends the cap pin(461) by means of its wedge slant and it opens in this way the valve downstream of the CO_2 capsule. The profile guide(490) of the cover plate(492) by deflecting the guide pin(491) for the snap-in bolt to be displaced against its spring action. Both of the slides(487,489) are unblocked in this way. As can be seen quite distinctly on the right side ofthe tranversal section, the edger bar(493) issuing form the central pin is provided with nape-type tipping means(494) which comes to rest, when lifted along a stroke length, in a recess of the valve opening slide, thereby preventing its return movement under the influence of the compression spring(495). In the peak position of the central pin its nape-type trip leaves that recess in the valve opening slide so that the latter can returninto its initial position by closing the valve. The slide(487) is only then in a position to return under the effect of the compression

spring(496) in its initial position, when its wedge slant has, subsequent to the descendent of the central pin, has left the end roller(486). This return movement is effected by the movement of the cover sliding head(292) first under the effect of the compression spring(291) -which sliding head is shown in Fig.13- via the wedge slants acting on the end roller(498). The cover sliding head, in its turn, is first activated when, by way of lifting a dosing spindle(263) on account of its interconnection, via the connecting link(476) the cross or transverse pin has been raised via the snap-in stage in the oblique slot(267)(Fig.13,19). Together with lifting the connecting link the rod of the venting valve(324) attached thereto is also raised against the action of their spring means, and the suction cup is revented.

Figure 24 is in its upper part a longitudinal and in its lower part a cross section showing the counting mechanism for the number of dosing to be carried out. The stem(502) which, in extension of the central pin, sets out from the semi-groove, actuates the transport means of said counter by lifting the pinion(504) within the switch jack (503). The four switch cams(505) are guided within the four axial guiding grooves(406). Lifting and lowering effect in same shares a rotation of the narrowthooted whell(507), which rotation is transmitted by it to a flat and broad toothed wheel which operates as counting wheel equipped with a number scale. The counting wheel is mounted on a pin(512) having fine threading thereon. This pin is gradually raised in its threaded bush until the cam(509) hits (after one cannula magazine has been emptied) against the the locking pin(511) on the blocking slide(510)

activation the blocking (after the cannula magazine is renewed) may be relaesed. When the insulin supply is exhausted, the cam(509) pushes against the locking edge(513) on the locking slide. The blocking is suspended by screwing backwards the great toothed wheel(508) by means of a socket wrench. The number of rotations events according a table which is fastened at the device, whereby the number of utilizations is classed with the heigth of the both adjustable insulin doses.

Figure 25 shows in the longitudinal section on the scale of 5 : 1 the mechanism of the counting device transport with pinion(504), gear cam(505) at gear bush(506) and the little toothed wheel(507).

Figure 26 reproduces a rolling up of the inside of the gear bush(506), whereby the arrows mark the path of a gear cam(505).

Figure 27 shows in the longitudinal section in the scale 1 : 1 a cannula magazine(262). Schematically with dashed lines the cannula bank-up tube(289) is transformed to a such manner as to lead back used cannulas into the magazine. A cross section of the magazine, inside the bent of the upper magazine on the scale of 5 : 1 with a flattening, continues in bent toward the right and it shows in the longitudinal section the position of stack cannulas with curved back(515), which cannula is also shown in the cross section and in the vertical section. The push-on spring(516) effects the pushing upon the drug outlet opening through a thinning of the magazine wall.

Figure 28 is a longitudinal section on the scale of 5 : 1, showing a dosing pump wherein the flow of the drug occurs from the bottom to the top. Such a pump can be used with the equipment of Fig.13, but also with those of Fig.78 or 82. It consists of an

outside piston(518) which is sealed with respect to the cylinder(519) by means of seal(517); furthermore, of an inside piston(520) slidable in the inside bore of the outside piston, and it can be closed against the conic slant or obliquity (523) by means of the seal or packing ring(521) in raising the inside piston or the piston bar (524). When the piston bar descends for opening the valve subsequent to the termination of the dosing stroke (upward), the inside piston enconters resistance on the stop bush or sleeve screwed in the outside piston. Both pistond can thus be descended together during fluid flow (through). Dosing takes place by raising the piston bar after closing the valve on the seal or packing ring(517).

The view in cross section to the right of the longitudinal section shows fluid passageway(525, 526) quite clearly.

For making an injector according to Figures 13 to 27 operative a protective sheeting or foil covering a plug-in unit -which is renewed as entity- is withdrawn. Water -preferably fro a prepared syringe- is filled in past the CO_2 gas pressure capcule. The plug-in or slide-in unit is the placed under the cover bridge(260), the fixing spindle is placed in the wall furrow or channel(460) of the plug-in unit(cf. Fig.14), and this is screwed with the installation part by using the holding arm(341) as lever arm. Thereby, the cannula(297) pierces through the belonging seal toward the gas storage space(480) and the air-free fluid coupling to the bag(271) is effected. After the predeterminded time, the swelling pin(270) has taken so much whater as to have araised the cO_2 capsule against the mandrel (358), whereby the latter has pierced the soft

iron seal. Subsequently, a cannula magazine is inserted from above. As far as the seat of the tublet with the drug outlet opening(440) is complete inside the wall of the cannula magazine (c.f.Fig.14) the central pin(433) must be elevated shortly as to let past the ratched ball (527). At the dosing screws not are adjusted the dosage steps -p.e. for morning and evening-by adjusting on the height upon the dosing spindles compared with a scale. The pressure spring (284) s streched by pulling down of the traction-loop(288) in which the fingers are stuck in. Thereby, the piston(168) is descended and is filled through the afflux lead or channel(528) and the sliding valve(Fig.13) with auxiliary fluid from the bag(272). If the the flaps(445) are pressed together, the cover slide is shifted towards the left hand side against its pressure spring. Thereby, the piston of the slidingvalve (265) is sunk and the derivation channel or drain(529) is given free towards the step syringe cylinder. Through the plug-in bushs(235), wherefrom the leads or wires extend towards the sliding contacts(584,Fig.27) for the cannula contact, the connection towards the measuring device follows. The counting wheel for the locking of functions, after the cannula or the insulin supply are exhausted, must be rotated back, otherwise the motion of the central pin within the gear busch(503) being stopped(Fig.24). During the swiveling of the suction cup cover (342) the last cannula, which closes up the magazine, -within the beginning of the magazine this is a shaft-less cannula body- will be removed. If the suction cup is pressed against the skin, the central pin, projecting a bit, is raised yet before the suction cup rim has touched the skin, and the gas stream towards the gas jet

pump(257) is given free. The ratched ball(527) receeds into the flattening of the central pin (Fig.18). Therewith, the cannu la steps lower and thus is done under the influence of damming up gas between the nonreturn valve(295) and the sealing body(585) at the end of the cannula magazine; subsequently said cannula steps towards the skin, whereby the hollow space connection between cannula shaft and drug outlet opening, prior interrupted, is restituted. During the further raising of the central pin, which may success without resistance by the elevation of the skin due the particularity of the shaping of wedge profile(Fig.24) on the slide(487), this activates the trigger or release(419,Fig.20.21)? Therewith the sliding cylinder(285) is moved together with the piston(268) on its piston rod (524) by the pressure spring(284) so far as the wedge(287) permits as to its stop on the dosing nut(264). The auxiliary fluid is transfered throughthe sliding valve behind the separation piston(276) and it replaces with this the drug being beneath to them, which drug is emptied through the cannula into the tissue. The conical narrowness is choiced such as to compensate the rubbing away of the wax envelope(276) at the wall without effecting a overflow of fluid. Due to the higher viscosity of the auxiliary fluid If there would event troubles more easily drug would be shifted upwards as auxiliary fluid downward. The clearance for motion of the dosing spindles on their connection strap(476) was calculated into the dosing extend. Together with the dosing spindles also the sliding valve is elevated and the its cross pin exceeds the short vertical distance within the oblique slot(267). The sliding coupling (269) permits the further elevation of the,

rod of the sliding valve and the activation of the reventilation valve. Such is effected by the movement of the covering carriage or slide to the right hand while the flaps open. Provided that the patient wants to correct the dosage after he has read the measuring results, so he holds both flaps pressed together so long as he desires the reventilation.

The Figure 29 shows in a longitudinal section an electrically driven injector with step syringes for two different drugs. The both step syringe cylinders are sliped in container cylinders(820). Above to the drug liquid the separating pistons (275) are positioned, above to said the screwed mandrels(856) are positioned within protecting folded bellows(854) fastened to these and safeguarded against turning. The latter are driven on, shifted in height, by the inner screw of the little gear wheels(839), which are driven on by the great gear wheels(859) above to the electrical motors(855). The lid plate(819) holds the gear wheels fixid to the housing. Whereas these motors are positioned behind the section plane, the step syringes continuous with own cannula attachment piece each into the suction cup(173). Around the rims of this the three triggering pegs (853) are arranged, whose pressure contacts must be closed to start the compressor(830), which is arranged behind the suction cup. The contact bars(858) for the cannula are operated by sticking one of these onto the respective cannula attachment piece. The central sensor pin(829) mediates the raising up of the skin by closing of the contact what launches the injection. Generally, it is sufficiently to choice a kind of earth contact close without additional expenditure of power for the activation of a switch.

At both sides of the control housing(839) with the control unit the gear wheeles(832) for the dosage choice are positioned.

The Figure 30 shows in a plan view the injector of the Fig.29. Additionaly to the gears the fastening screw and the holding clamp(878) are visible. Further, the change-over button(834) for the run back of the motor, and such with aim to lift up the screwed mandrels before the step syringe are withdrawn; further are shown the program changing switch(864) and the pressure switch (874) for the reventilation valve(875) with the ventilation channel(870). Additionally the position of the battery(845) is given.

The Figure 31 shows a circuit diagram in TTL for Fig.29 and 30. Part A desigs the energy supplying, (B) the choise of the dosing programm, (C) the check of the start conditions, (D) the programming of the dosage, (E) the restoration of the conditions at the beginning. By fixing of a cannula one of the contact bars(858) is operated and the appertaining contact is closed an in part C the both AND-gates(1) compared for correspondance by means of TTL SN 7408 and the EXOR-gate TTL 7486. The circuit leads from there towards the AND-gate(2) TTL SN 7408, which interrupts the circuit to the compressor(830). If the AND-gate on the suction cylinder or suction cup is closed three times (by positioning onto the skin), then the flip-flop switch TTL SN 7474 turns the compressor sucking by means of the transistor T(1). Now negative pressure is created in the suction cup through a suction tube; the skin is lifted in the suction cup and thus activates the

contact bar(829) for its part and thereby it switches the NAND-gate TTL SN 7400 from the position low to the position high. In Part D for the choice of the stepping motor the stepping motor for the dosing screwed mandrel(856) or (856') is brought from low to high over the transistor(2), it depends from the position of the bistable relay; when the bistable relay and the compressor have been switched on. The trigger cam contact(856,856') is activated by every revolution fo the gear(859,859') and leads into the decimal counter TTL SN 7490. The comparison of the counter with the preselection switch occurs by means of EXOR-gate TTL SN 7486 with respectively classed with diodes IN 4148, until the flow of current has been switched at point E from high to low. The counter is set at the zero-position by low at E by means of the AND-gate(3). Over AND-gate(4) the compressor is switchet out; by means of AND-gate(5) the flip-flop switch is flipped into rest position. The transistor(3) insures by means of the switch-reset, that the bistable relay does not change its switch position because of the turning on and off of the device. The magnet reventilation valve(368) is activated by the monoflop TTL SN 74 1221 by means of transistor(4) for a duration which is predestinasted herefore in the course of which air enters into the suction cylinder or suction cup. For the reventilation, the inlet of air onto the suction cup also may be given free by activation of the pressure switch(874) through the ventilation channel(870), whereby the seat valve is opened by hand.

The Figure 32 shows in the longitudinal section a variation to Fig.29. The construction of the appa-

ratus is to be understood as follows:
Between the covering plate(2) and the cross-beam (884) of the housing(1), there are the square shafts(885,886) in their bushs(887,888,889, 890). The square shafts are secured against fall ing out by clamp rings; the square shaft(885) is connected to the driving shaft of the electric motor(855), and this driving shaft is connected to the compressor(830). The first great gear wheel(893) rests on the square shaft(886) and is carried along with it. The other gear wheels run on the bushs exept for the last gear wheel (815), which is connected to the square shaft(886) and transfers in a retarded manner the revolutions to the dosing disks(816,325). This is done by means of a pinion(800), which is shiftable along the square shaft(886), and which is enmeshed in a bush(802) with inner teeth by means of a plunger case(890), which simultaneously serves as a pin shell is fixed by a latch(801) engaged within an annular groove (said latch being in a pulled position). Said bush is firmly fixed with the dosing disk(816), which works squeezing to the drug hose and its disk bearing by its rollers and which may displace the drug toward the cannula attachment piece. If the pin of the plunger case (890) is pressed the pinion is shifted to the right and enganges with the inner teeth of the bush(820), which is fixed with dosing disk (325). Now is dosed out from the other supply container through the hose(44). After the starter lever(803) is pulled, the centrifugal force regulator, the weight burdened swivel arms(804) of which are drawn back from the prop of the cross beam(884), starts to function driven by the motor by the transmission of the square shaft. Therefore, the electrical switch contact(197)

is activated simultaneously with the operation of the starter lever. At the same time, the fashing, which is hollowed out in a pot-like manner, is shifted with its swivel arms along the square shaft surrounding the attaching head of swivel arms and it is pushed to the left against its adjustable spring. This spring mechanism causes, shortly after the number of revolutions of the motor has been reduced by the turning off of the motor, a blocking of the rotation of the swivel arms on the housing prop. The dosing occurs with control counting by the switch came (856) by means of the electronic control unit (175). The sealed housing is connected to the suction cup by the suction channel(809) and has the ventilation nozzle(869). The starting lever (803) and the plunger case(890) are sealed to the housing by folding bellows. There are contact pins (858) spring biased next to the two cannula attachment pieces. The sensor(829) is positioned between the the cannula attachment pieces and is activated by the skin which has been drawn up by vacuum. Three contact rods(853) for starting the motor are near the suction cup rim. The choice of programming takes place by means of contacts, which are activated by means of the end positions of the plunger case(890). The batteries are not shown.

Figure 33 shows a simplified electronic wiring diagram for this. The given voltage should be on the contact points which are designated 5 V, and the voltage of the entry gate-reset on the points designated R. Individual wiring as well as the diodes against locking currents are omitted for lucidity. After the switch for choice of program has been set for the dosing, the hand,acti-

vation of the switch-reset causes a slow build-up of voltage 5 V on a condensor, in order to bring the switch into the zero-position. The bistable relay of B stands on programs I or II and can be manually switched by th rogram change button. The pressure contact(858 or 858´) is closed by the placing of the cannula on the cannula attachment cone and, in part C, compared for correspondance by means of the two AND-gate(1) TTL SN 7408 and the Exor-gate TTL SN 7486. The circuit leads from there to the AND-gate(2) TTL SN 7408, which interrupts the circuit to compressor (830). If the AND-gate on the suction cylinder or suction cup is closed three times (by positioning onto the skin), then the flip-flop switch TTL SN 7474 turns the compressor sucking by means of the transistor T(1). Now negative pressure is created in the suction cup through a suction tube; the skin is lifted in the suction cup and thus activates the contact bar (829) for its part and thereby it switches the NAND-gate TTL SN 7400 from the position low to the position high. In Part D for the choice of the stepping?motor the stepping motor for the dosing screwed mandrel(856) or (856´) is brought from low to high over the transistor (2), it depends from the position of the bistable relay; when the bistable relay and the compressor have been switched on. The trigger cam contact(856,856´) is activated by every revolution fo the gear(859,859´) and leads into the decimal counter TTL SN 7490. The comparison of the counter with the preselection switch occurs by means of EXOR-gate TTL SN 7486 with respectively classed with diodes IN 4148, until the flow of current has been switched at point E from high to low. The counter is set at the zero-

position by low at E by means of the AND-gate(3). Over AND-gate(4) the compressor is switched out; by means of AND-gate(5) the flip-flop switch is flipped into rest position. The transistor(3) insures by means of the switch-reset, that the bistable relay does not change its switch position because of the turning on and off of the device.

Figure 34 shows in a sectional side-view a medicine pressure bottle, the upper wall limitation of which is drawn in a dish-like manner into the folded bellows(831), that there is room in the dish hole(822) for the bottle neck together with the hose(44) which is wrapped around the connection fitting(838), what allows to pile up such bottles. A clamp clip(823) prevents medicine or drug from flowing out into the hose by gas pressure on the folded bellows.

Figure 35 is a lateral longitudinal section a variation of the container, consisting of a less elastic outer container which is filled with pressurized gas. Within it, there is a further membraneous container(408) with liquid which empties solely through the hose(44), after the clamp clip(823) is removed. The hose is surrounded of a attaching plate(838) which is sealed to it.

The Figure 36 is a schematical plan view showing a suction injector as a prefered elaboration of the invention. Inside the cannula magazine(262), which is developed as a spiral wound hose, the storage of stack cannulas of two different construction are seen in the longitudinal section. (The mentioned cannulas, which permit an automatical cannula change, are described in the Fig.48,49 more distinctly). The dosing is provided for two drugs or medicines, programmed and corrigable in dependence of the measuring results. The sectional planes for the following figures are given. It are demonstrated the cylinder(304) for accomodation of the suction piston, the inserting cylinder(334) with the dosing devices and with the drug supply containers, the hinge or joint(322) for the holding arm of the suction cup cover, the central bearing tube(314) for the cannula magazine, the guiding cylinder (313), the tube(319) for the pressure spring with the Bowden cable which leads back the suction piston, the protective tublet(320) for the tensioning end of said pressure spring and the pass tube(321) for the forth Bowden cable for the tensioning of the tension spring of the suction piston. The banderole(400) corresponds to a end of magazine prior to use. It holds the cannula back in the magazine means of a pin, which is stuck

through the wall, which cannula stay with its tensioned pressure spring with sealing bodies (370) on its ends.

The Figure 37 reproduces in the longitudinal section on the direction toward A - B of Fig.36 the suction injector during the suction cup cover is already closed and this is done before use. The suction cylinder(301) with thightly grinded-on suction piston(302) in its interior is supported at its lower rim by the bottom cylinder(304) and at its upper rim by the cylinder (304) for the tensioning piston(405). The tension spring(306) which extends between the suction and the tension piston and which is fastened at both is tensioned. The suction piston stands in vicinity to the annular piston(307), wich is something shiftable along the central pin(308), which is fixed on the bottom cylinder, and its permanent magnets -concentric arranged pin-type fixly inserted- contact on a annular socket ledge on the bottom cylinder with a iron ring, which is fixed there. The upper ends of the permanent magnets(309) are inserted in a soft iron ring(311), which is sealing fastened at an elastic-membraneous septum(312). This septum divides the cylinder space in a greater upper and a minor lower part and is interrupted by the sliding non-return valve, into the afflux lead bore thereof the sand filter(393) is pushed in.

Also about the central pin the septum is sealed by screwing. The central pin shows on its lower end a spindle-like swelling up with a flattened increase of curve above and a steeper below. The bending spring(325) which works inwards with her power working even yet clings to the lower part of curve and the stop angle(327) is engaged by its pressure spring in a slot of the shell(369), which is fastened at the suction piston. The central telescopic tubes(328) between the suction piston and the tensioning piston are extended asunder. The central blocking rod(329) is drawn downwardly after its spring is extended. Through that the blocking members(330) may be withdrawn from the obliquity of recess of the roof-top(331). The movement downwards of the tensioning piston is also blocked. The rod of the reventilation valve(324) with the sand filter(393) is pressed from the annular piston. The suction cup(351) is arranged movable inside of the guiding cylinder(313) against three pressure springs, whereby the downwardly movement is limited by the arreting spring(353) for the steering of cannulas by means of the triggering cam(355) of the triggering rod. Between the lower edge of the suction cup and of the guiding cylinder an elastic sealing sleeve(352) is stretched. Along the three borings for the uptake of the pressure springs(334), to which the retaining arm(357) of the lid(342) of the suction cup counteract, the suction cup yet contains the passage(359) for the triggering rod, which downward amplifies funnel-like, whereby its guidance permits by a certain elasticity of the holding arm(341) for the cover of suction cup to approach the intake tube(358) perpendicularly. A little tube(459) which is shiftable onto that intake tube against a pressure spring, shows on his lower end claws(361) which anew work on to the cannulas through slots of the intake tube

by shifting. In counter position to the described claws from the ends of the intake tube itself spring claws(360) expand, which engage into the ring groove of the cannula used atleast after the spring biased tube(459) is shifted back by pressing on against the central holding tube(314) during the lid is closed, after that cannula was depressed in lower position because the arreting spring(353) was retracted by the triggering rod (336) by influence of the pressure spring(Fig.26). inside of the cannula magazine. The lowering of the tube(459) during the lid is closed also effects, that the cannulas which are inserted below into the intake tube, are pushed forward and upwards. If the lid of the suction cup is opened the triggering cam(355) passes the arreting spring(353) again, through that the next cannula is able to be depressed in a lower position. It than lies with the lower edge of his body onto the arreting spring, while the ring groove(381), which has a hollow space connection to the cannula shaft, is positioned over the boring for the angle(343) of the medicine supply vessel in the cannula magazine. The prior used cannula lying inside of the intake tube is removed during the lid is opened, whereby the spring claws (360) hinder them to fall out. Under the lid of the suction cup at the holding arm(331) the bayonet coupling(362) is shown
in the cross-section over the suction cup are shown beside of the position of the cannula magazine(316) inside of the central holding tube(314) and the three pressure springs(354) and the passage(359) for the triggering rod and in both slots (363) the both tubes with the angle(340) for the supply of the medicine and inside of the central holding tube the both electrical wires(364) from the slide-contacts on the cannula towards the con-

by shifting. In counter position to the described claws from the ends of the intake tube itself spring claws(360) expand, which engage into the ring groove of the cannula used atleast after the spring biased tube(459) is shifted back by pressing on against the central holding tube(314) during the lid is closed, after that cannula was depressed in lower position because the arreting spring(353) was retraited by the triggering rod (336) by influence of the pressure spring(Fig.26). inside of the cannula magazine. The lowering of the tube(459) during the lid is closed also effects, that the cannulas which are inserted below into the intake tube, are pushed forward and upwards. If the lid of the suction cup is opened the triggering cam(355) passes the arreting spring(353) again, through that the next cannula is able to be depressed in a lower position. It than lies with the lower edge of his body onto the arreting spring, while the ring groove(381), which has a hollow space connection to the cannula shaft, is positioned over the boring for the angle(343) of the medicine supply vessel in the cannula magazine. The prior used cannula lying inside of the intake tube is removed during the lid is opened, whereby the spring claws (360) hinder them to fall out. Under the lid of the suction cup at the holding arm(331) the bayonet coupling(362) is shown
in the cross-section over the suction cup are shown beside of the position of the cannula magazine(316) inside of the central holding tube(314) and the three pressure springs(354) and the passage(359) for the triggering rod and in both slots (363) the both tubes with the angle(340) for the supply of the medicine and inside of the central holding tube the both electrical wires(364) from the slide-contacts on the cannula towards the con-

trol unit.
in the cross-section on the right the position and the fonction of the bending spring(325) below the flask-like swelling of the end of the central pin (308).
The Figure 38 gives in a schematical longitudinal section along the sectional line C - D of the Fig.36 a supplement of the construction of the device. Inside of the cylinder(304) for the tensioning piston(305) this is lowered by the influende of the tensioning spring(306). The suction piston(302) inside of the suction cylinder(301) again lies below over the septum with the nonreturn valve (323) and the the annular piston(307) whereby the bending spring is enganged to the central pin (308) and the permanent magnets work. Below inside of the slide-in-cylinder(334) lay the both dosing mechanisms(337,338), whereby one of both elastic tubes with the angle(340) is shown. The slide-in-cylinder is held by a rail(336) on a ring around the suction cylinder and pressed downwardly by the violent spring(335) under the stationary housing (315) with the control unit and the electrical battery. The both medicine supply containers lay inside of the slide-in-unit and with it also against the lid(339) of the suction cup.
Figure 39 shows in a schematical overview toward even this lid of suction cup(339). Around the slide-in-cylinder is shown over it a winding of the hose of the cannula magazine(316). The tubes with the angle(340) pierce the sealing sleeve(370) next to the central holding tube(314) into the suction cup. As the barrier(357) for the roof of the suction cup a bolt is drawn in.

Figure 40 shows in a schematical longitudinal section along the sectional line E - F on Fig.36 the position and function of the parts for the

preparation of the function of the suction pump by the swivel of the lid of the suction cup by means of the holding arms(341). Immediately before the injection this was swiveled out the position(shown by shared lines) during the lid of suction cup is closed about 180 grades about the hinge or joint(322) to close up the suction cup setting forth the fonctional stage which is shown in Fig.37. Therby was by the tensional working of the bowding wire with the coat(344), which is traduced inside of the protective tube(320) after it is bent over a loop and which is finely connected at the end of the lever arm(345) with the hinge or joint, the pressure spring(332) inside of the cylinder tube(319) tensioned during the lower guiding piston(349) was lowered, without the last would been able to transmit its moment of movement through the bowden wire with the coat(345), which is fastened on the centrally pierced upper guiding piston(349). The upper guiding piston was already lowered with lifting of the tensioning piston(305) during the lid was closed. The tensioning piston thereby was lifted by tension at the violent bowden wire inside of the coat(346) from the end(347) of the lever arm through the guiding tube(321). When the tensioning piston is lifted inside of the roof-top (also nearly to the upper end position of this) is arrised thereby the blocking membres(330) was urged into the recess of the roof-top by the lowering of the blocking rod(329) by means of tension from the telescopic tubes, through that the returning movement of the tensioning piston remains blocked by the influence of the tensioning spring(306) (as demonstrated in Fig.37). By self-winding up of the corde-like end(348) which continues the violent bowden wire, the movement for opening of the holding arm(341) has been released.

Figure 41 shows a partial exhibition of the fonctional stage after the tensioning piston is removed and the injection is performed. The lid(342) of the suction cup yet is flapped away. After the electromagnetic valve(324) for the reventilation of the suction cylinder(301) is oppened, the suction piston(302) was drawn near to the highly positioned tensioning piston by the working of the tensioning spring(306). After the it was relieved from the tension of the tensioning spring(306) the blocking rod(329) was raised by the working of his spring, so that the blocking membres(330) has made away into the recess of the roof-top by working of the lower obliquity of wedge inside of the recess of the roof-top into the annual groove of the blocking rod. Now the pressure spring(332) was able to detend by pressing entirely downwards by means of the bowden wire inside of the coat(345) the tensioning piston (305), which was yet lowered by the influence of the suction cup and the tensioning spring(306). Finaly the suction piston thereby fell in the influence of the permanent magnets(309) and the bending spring(325) engaged to the central pin(308). At the same time the stop angle(327) and thereby the suction piston was arrested against the arresting ball(366). The lowering of the annular piston(Fig.27?) had effected that the arresting ball made away into the niche destinated for it. By the influence of the pressure springs(354) the suction cup(353) now was lowered in its guiding cylinder(313) against the skin. At the same time oppened also the reventilation valve(324) by the stroke of the annular piston against the valve rod of this and the suction cup was reventilated by the bore for the arresting or catch ball(366) (Fig.37, with a low level of the tensioning piston as in Fig.38).

The Figure 42 reproduces the schematical functional process for the tensioning mechanism of the suction piston in the stage of the closure of the cover of the suction cup. The tensioning piston(305) is arrised at its bow(531) by the violent bowden wire inside of the coat(346) towards its upper arresting position whilst its corde-like end(348) was extended during the the lid was closed. Therby the tensioning spring(306) was tensed. The bowden wire inside of the coat(344) was detended and thereby the lower guiding piston(349) with the detended pressure spring was lowered, whereby also the upper guiding piston(350) was shifted downwards by the bowden wire inside of the coat(345) in the cylinder tube(319). To lengthen the lever arm of the holding arm(341) for the closing of lid of the suction cup may serve the extended telescopic rail(343).

The Figure 43 reproduces in the longitudinal section a detail of a variation of the triggering mechanism for the suction piston, which allows to avoid the septum and the movable annular piston. Instead of the arresting ball(366) there is a rod(406) which is sealed by a folded bellows, which engages to a groove of the suction piston(305) at the left side. The bending spring(325) again brakes the raising of the suction piston by influence of the tensioning spring(306) at the club-like swelling of the central pin(308). The reventilation valve(324) is opened by the support of the suction piston against the spring biased valve rod and therefore also the connection of the suction cup towards the outern air is opened by the channel(532) through the sand filter(594). The bore for the nonreturn valve(323) expands parallel to the rod(406). If the suction cup is raised, its trough(365) comes in the area of the cap of rod, which entrates into this by influence of the obliqity of wedge of the groove inside of the suction piston which raises. Now the suction

cup is arrested whereby the partial vacuum, which forms inside of the suction cylinder, the air from the suction cup filtered sucks on through the air channel(533) during the nonreturn valve(323) opens. The reventilation valve(324) is closed and will be opened first again by the return of the suction piston during the suction cylinder is reventilated through the electromagnetic valve (which is not drawn in), while the reventilation through the air channel (533) untill than is closed by the nonreturn-valve (323).

The Figure 44 shows schematically in the longitudinal section through the detail of the suction-cup-area a device and the function of the refilling of a supply container for drug at a device according to the Fig.37. The central holding tube(314) is shifted downward in its seal(534) on the cover of the suction cup. The relating drug support tube is withdrawn at its angle(340) out from the bore of the central holding tube and it is introduced in a bore of the plug-bush(535), while the otner bore of the plug-bush is connected with the drug supply tube of the new supply container and that by pluging -in of the cone at the end of the hose(44).

Both dosing pumps are represented in the longitudinal section on Figure 45. From the supply bag(408) leads the drug hose(44) to its sac-like amplification between the pump cylinder(111) and the dosing-pump-pegs(337,338) andcontinues to the tube with the angle(340) which contacts through the cross-bore in the central holding tube(314) and through the cannula body with the cannula shaft. On the cross-section represented below along the line A - B of the Fig.45 nearly to the dosing-pump-pegs (337,338) the arrangement of the liquid pumps(409, 410,411,412) is recognizable.

On the Figure 46 the enlargement in the scale 5 : 1 allows to recognize more certainly the com-

position of the dosing pump. On the pump-peg builds three annular grooves each a dosing chamber(416). The hose ring(415) which is attached to it, is fixed in the height in a groove-like bulge of the axial bush(116). If the hose ring is blowed up this displaces the fluid out from the dosing chamber and its environs and locks then the fluid stream, whereby it leans to the edges of the grooves. The fluid stream towards the cannula leads through the channel(417). The fluid pump in the Fig.46 builds a variation. From the three fluid pumps for the auxiliary fluid attached each to a hose ring, only one is demonstrated. Solenoid(413) and resilient spring(414) work to the folded bellows(418) according to the succession of pulses as described next to that, which causes at I the injection, while at II is effected a filling back.

In Fig.47 two fluid pumps serving to activate a dosing pump as douple-working piston-cylinder pump are demonstrated in connection with the solenoid (413) and the resilient spring(414), whereby the both ends of cylinders are connected with at least one hose ring. The middle hose ring(415) is connected with each end of cylinders opposite by hose. Fig.47, additionally, elucidates the pump function. On the basic stage A both piston are depressed by spring effect. The uppermost hose ring is discharged from fluid, while the lower and the middle hose ring are blowed up by abundance of fluid. On the stage B the uppermost hose ring is blowed up and the middle ring is relieved and th both others are blowed up. The impuls series --, +-, ++ has the effect that a certain quantity of drug is desplaced from above towards below to the cannula and the fluid stream is locked

Figure 48 shows a stack-cannula(318) made of gumelastic material as Perbunane enlarged in a scale 3:1.

To use it special sealing elements especially around the entrance channel for drug or into the cannula magazine are not necessary. The upper and the lower chamber are connnected one with other by a taille or incision which works like a joint.
The upper chamber serving as accomodation bore for the shaft of the adjacent cannula may be shaped comparatively narrow because bending of the magazine hose are equalized by its incision. The silvered stripe(382) expands as conductive path from the bottom face to the cannula shaft. On the cannula shaft an enzymatic layer(383) is shown. The bodies of cannula may be pasted one up the other at its edges before used, so that the sterility of the cannula shafts is guaranted.

Figure 49 shows an other stack-cannula in the longitudinal section. The cup-formed body of cannula(317) is divided in a lower chamber for the fastening of the cannula shaft(379) into the bottom plate of it and in an upper chamber to take up the cannula shaft of the following cannula by a separating wall. The upper chamber is closed off by the membrane(380) which is centrically pierced. Inside of the lower chamber the cannula shaft bends angle-like(?) towards a annular groove(381) surrounding the body of cannula into which it is oppened. The annular groove has toward belove an a steep surface, which supports the claws(361) of the cannula-intake-tube and it extends softly ascending upwardly and outwards., to fazilitate the transport of the cannula downwards, wherby the claws must leave the annular groove.
The extend of the annular groove up to above of it has a stripe with a silvering, while the cannula shaft itself is platinized to transfer weak current without distortion of voltage to the contact spring at the central holding tbe for the cannula magazine. The body of cannula is made of casting plastic material as par example polyvinylchloride. The necessary annular seal inside of the central holding tube (314,Fig.37) is not drawed. The enzymatic coat(383)

is drawn in. The further conduct of current takes place through the silverchloride-silver-layer of the arresting spring(353) provided to change cannula, while its underface is electically isolated to prevent the skin contact. On the other hand the use of a contact gel -as usual at the electrocardiography- is necessary to guarant the measurements.

It may be used also a ring-formed electrode adhesiv on both sides(Fig.94), which is sticked on the suction cup rim and which is well conductive towards the silver-layer. By thus a adhesive conection the safety of application may be increased, solong as yet considerable reaction periods are necessary until the measurements are completed, because the maintenance of negative pressure inside of the suction cup is better guaranteed. The annular groove(582) in Fig.49 serves to the fixation by the arresting spring(353).

The Figure 50 shows above in the longitudinal section and below in the cross-section in the scale 5 : 1 the variation of a sensor cannula in a side-view. The cannula shaft is grinded off behind of the area of the yet closed point(541), so that the bore of the cannula would be open as trough(542). But the wall of the shaft was closed by the plastic insert(543) eith the isolating zone(544) towards the cannula shaft.

Figure 51 shows in the longitudinal section and below in the cross-section an other variation of the sensor cannula. Inside of the shaft is layed in a nearly capillary thin little hose(545) or a thread, the surface of which could have sensor quality. As into the others it may be possible that apart from blood also liquid of tissue may be sucked on by the capillary effect (or by application from suction from the drain tube.

Figure 52 shows a longitudinal section through the end of shaft of a sensor cannula, by which the wall at the point-area is thinned from the inside and

coated with the sensor layer(383), so that the last not can be sliped off during it is sticked in into the skin. The stability of the cannula shaft remains conservated by the part with thicker wall. In the inside of the shaft a little wire(577) forthe derivation of current is perceptible.

The Figure 53 shows in the longitudinal section a sensor cannula similar as thus of the Fig.50. But on the open trough(542) of the shaft is layed in a little hose(545) or thread with sensor quality. Because the operation of glucose specifical enzyme layers exceeds the possibilities of the inventor was provided a electrolytes containing gel with sugar-specific adsorbent for doting as coat to alter the electrical conductivity on a platin cannula connected with the measuring instrument.(Par example the adduct sepharose-concanavalin A of "Pharmazia" Freiburg-Breisgau).

The Figure 54 gives a photometric version of the sensor cannula p.e. for the determination of glucose, whereby the light source(560) and the optical detector(561) and the cannula are shown in the longitudinal section. Inside of the cannula attachment piece(47), which surrounds the cannula shaft, atleast one fiberglas filament(885) leads from that indicator layer back through the shaft. Around the medicine applying end of hose with the cannula attachment piece lies the contact-ring(587), from which a fiberglas bundles lead back towards the light source and other towards the detector. If the cannula is introduced into the tissue than the indicator layer responds to the glucose of tissue changing colour dependent of the concentration of glucose. The reduction of the light signals which are led back may be evalueted according to a oaken comparison to the measuring value. It may also two fiberglas filaments lead towards two indicator

layers, which are charged qualitative differently, and backward , whereby the latter possibly are sensible for different time point of measuring and for different concentration ranks. Such optical indicator layers are p.e. paper impregnated with glucose oxydase or peroxydase to which is added as color donator 3.5.5-tetramethyl-benzidin-dihydrochloride respectively 4-aminoantipyrin-dihydrochloride and natrium-3.5-dichlor-2-hydroxy-benzolsulfonate is added as color donator.

The Figure 55 shows in the longitudinal section a sensor cannula at which is brought on instead of a color indicator a half-moon-formed mirror(588) is attached at the point-area of the inside of the shaft (the mirror may consists of silver steamed on, which is coated with silizium dioxide to protect it for oxydation.) At the left hand may be recognized a light conducting fiber(585) inside of a cannula attachment piece(47), which is connected to a light source. The free light-ray towards the mirror, on which he is reflected through the liquid of tissue ba the other side of mirror and reaches a fiber of the light-conducting-bundle of the detector, is presented in dottered lines. The rotation of the polarization plan by the glucose is evaluated by the computer.

The Figure 56 shows other features of the invention according Fig.55. To avoid the problematical- and expensive optical coupling between the light-conducting-fibers inside of the cannula attachment piece and thus of the apparatus, the light-rays are projected from the sectoral disk(589) directly through the middle-bore of a stack-cannula (317,p.e.) into the cannula shaft and received also from there on the part of apparatus and transduced towards the detector in light-conducting-fibers (885).

The cannula bore is closed up downwards by the window-membrane(590), which lets through the rays, but not the medicine. The last is injected sideward from the annular groove(381) out from the medicine-outlet-opening(440) through the holding tu be(314). If the injection is completed, by lowering of the sectoral disk(589) the adhesive-centralized cone(594) is withdrawn out from the central bore and the by swivel around the (only outlined) axis according to a transport carrousel(211) the passage of the next cannula is given free. The mirror(588) may be steamed up with silver or aluminium as thus of Fig.55.

The Figure 57 shows in a lateral view and below in a cross-section a part of the control rings for the electronically programing of an injector as it is described on Fig.36-44. On the switching ledge(371) of the controller housing cylinder are to neighboring pressure contacts in pairs for one controll ring(372), which are operated its inner bounds of the controll rings being shaped undulatory one after the another following of each excavation and that as the direction of turning may be in the opposite sequence, whereby the ball catch(373) guarantees to shift these only by entire switching steps. By binary coding now the singular parameter as tissue-sugar-values or amounts of insulin may be perceived at its respective debit and nominal values for dosing and they may be represented and evalueted arithmetically. For the praxis already 20 switching steps seem to be sufficient, for the timing the hour-spaces with intervall between 0 and 5 hour clock (wherby an inversion of day and night may be equalized by conversion of the timer), concerning the tissue-sugar-levels in milligramm percent 20,30,4o... until 100, than 120,140,160...untill 300, than 350 and 400, concerning the amounts of insulin in units 4,8,12...80 further concerning the muliplaying constant (K1 for retarted insulin and K2 for immediately

working insulin) the switching steps 0,1,2,3..untill 19. as reference lines for the reading serve projections of edges on the intermediate rings(374) which are fixed upon the controll cylinder, a wire-bent or at its place a transparent plastic strip with the effect of optical enlargement will also serve, which may be turned away from the reading area, so that the elevated-shaped numbers may be reprinted for the registration. Salient edges(376) facilitate the turning og the control rings and hinder a turning over towards one direction. Neighboring control rings, which are functionally adjusted, may show a pin(377) with a hook-like angle, which bumps against the edge(376) and therby effects an automatically taking along one with other. 4 program-blocs (I-IV) are recommended which are composed each likely related to four preprogramable dates of application with an gratuated in hours preeligible minimal distance supplement bloc(V) exclusively for the additional application of immediately working insulin in particular to equalize mistakes of diet or of adjustment, wherby it remains as the task of the medicin to adjust the dosing of retarded insulin reasonable.

The Table 1 shows a composition of example-like programs and of the effects of these on the treatment of insulin. It is concerned of patients with application of insulin at the morning in the lowerst until the highest dosages recording to a quite different sensibility for this therapy. According the time-table no statements are given , the extent of tolerance of the debet-sugar-level was fixed a 90 to 120 milligram percent at a ideal value of 120 milligram percent. also the measured actual values for glucose are simplificated with once 180 milligramm percent and another with 50 milligram percent. Solely the correcture factor K2 for retarded insulin was varied by assessment and a correction with immediately working insulin was not comprised. The column of dosing correction, which is attended

by the computer, is represented for elucidating. The result of the correction, which consists in the case of the sugar level of 180 milligram percent in a increase and in the case of 50 milligram percent in a depression of the original doses, is evident from both vertical rows of numbers. Patient 2 theoretically have to keep at a blood-sugar-level of 180 milligramm percent 56 units retard insulin in addition, but what is not possible, because the maximum dosis is exceeded, but leads to the supplement program V with immediately working insulin. The same patient gets whatever no insulin if the sugar level is 50 milligram percent. A patient which is endanged by under-sugar urgently must be advised to eat and to inject before the meals, to avoid supplementary applies of immediatiely working insulin. On the other hand a other in the purpose to incorporate a rich meal can defer the injection towards a time after the meal and thereby obtain additional units of immediately working insulin. Even if the programming should be taken to task by the physician and therefore it´s provided a blocking of the rotation of the control rings by the pressure of a screw(384) which may be activated by key, what is promoted by ribs(383,Fig.57) on the plane sides of the control rings, neverless the patient has a lot of duties to cooperate and possibilities to influence, what also results from the description of synopsis of functions. Such a synopsis of functions, therof every trained expert is able to derivate a electronical block-diagram without difficulty, Figure 44
reproduces. Below with rectangles and circles the organs of functions are shown, as the timer(386), the suction cup(173) with cannula during the earth contact by means of the skin wich is drawn up by negative pressure, there are also reminder and warning devices(387) with the functions as acoustic and optical signal and vibrator, to facilitate the

use by handicapped persons (all separately to switch off by hand switches I/O), and the electrical measuring instrument with display and printer(389) and display and printer for the delivering units of retard insulin(390) and for immediatly working insulin units(391) and the dosing pumps (337,338). Over these inside of the rhombs lies the adjusting range of the control rings, inside of rhombs and rectangles with shared lines the measuring data of the actual glucose levels and its processing by computer. The timer gives the respective hour through the line(a) towards the clock for the comparison. A computer element there determines, how much before and after the clock-time and after yet works a signal from the measuring instrument(388) in the direction of the pumps through the line(b). Always free is the path of the line(d) from the cannula towards the measuring instrument(388) and towards its display and printer.

In the case of failure of the measuring instrument the patient has still the possibility to call off the normal dose by the hand switch(390) in the line (c). The adjusted clock-time is activated through line(e) of the warning device(387). If the assigned period for a treatment allready was passed over, the succeeding program is chosen on, what also is possible, if the program I is switched off on the hand switch(391). Programm II being also switched off by hand a dosing is not effected. The possibility to choice between two programs at the same time point increases the adaptability between the mode of living and the treatment. After the programing of time follows (read from the left hand to the right) through line(g) the nominal-value-program for the tissue-sugar-level with the desired ideal value in the middle and the limiting values above and below, during these are reached no dosing correction should taken place, the shared vertical lines with arrows symbolize that arithmetic statement

of the allowed deviation by the comparison from the preprogramming. The fourth lowest rhomb marks the (dangerous) extremely lowest value, from which leads a stopping signal during recording through the line(h) to the both pumps. If the sugar values lies higher so leads the line(i) farther into the direction of the dosing programs. When the measured sugar is lowered below the incorrected admitted value, the hight of the reduction from the retard insulin units is ascertained by arithmetic ascertainment of the deviation from the fixed ideal value and multiplication with the fixed factor K1, which is destinated by the distance of the lower rhomb from said normal dosis, and after these are deduct from the normal dosis according line(k), display and registration are effected and dosing through line(l). Through line(m) the delivery of immediately working insulin thereby is switched off. If the sugar values are measured as inside and upwards of the allowed tolerance the line(n) effects the program for the immediately working insulin to be switched to, whereby a eventually pre-programmed delivery of immediately working insulin is stimulated according to the arithmetic comparison between an excessive value and a nominal or ideal value after multiplication with the factor K2 through line(p) is effected. If the preprogrammed maximum dose is exceeded hereby, so is made a note of the supplement program through line(q), which effects the remembrance by the warning device inside of the limitations of time programmed there and which may be applied. Through the line(u) the electro-magnetic valve at(368) is oppened for reventilation. Reventilation is also effected through line(v) after the exclusive measurement of the tissue-sugar-level without a delivery of insulin(p.e. outside of the fixed limitations of time or according the intention of the

of the allowed deviation by the comparison from the preprogramming. The fourth lowest rhomb marks the (dangerous) extremely lowest value, from which leads a stopping signal during recording through the line(h) to the both pumps. If the sugar values lies higher so leads the line(i) farther into the direction of the dosing programs. When the measured sugar is lowered below the incorrected admitted value, the hight of the reduction from the retard insulin units is ascertained by arithmetic ascertainment of the deviation from the fixed ideal value and multiplication with the fixed factor K1, which is destinated by the distance of the lower rhomb from said normal dosis, and after these are deduct from the normal dosis according line(k), display and registration are effected and dosing through line(l). Through line(m) the delivery of immediately working insulin thereby is switched off. If the sugar values are measured as inside and upwards of the allowed tolerance the line(n) effects the program for the immediately working insulin to be switched to, whereby a eventually pre-programmed delivery of immediately working insulin is stimulated according to the arithmetic comparison between an excessive value and a nominal or ideal value after multiplication with the factor K2 through line(p) is effected. If the preprogrammed maximum dose is exceeded hereby, so is made a note of the supplement program through line(q), which effects the remembrance by the warning device inside of the limitations of time programmed there and which may be applied. Through the line(u) the electro-magnetic valve at(368) is oppened for reventilation. Reventilation is also effected through line(v) after the exclusive measurement of the tissue-sugar-level without a delivery of insulin(p.e. outside of the fixed limitations of time or according the intention of the patient). Through the pressure switch(392) the pa-

tient is enabled to interrupt the commanded run down into the direction of the injection after the skin is sucked on and during the measuring. If he releases the pressure switch after the ascertainment of the measuring values, so is effected (yet a little delayed) the injection. But if he activates the pressure switch after a short interval a second time, so the injection is broken off finely by reventilation. The consumption of medicine is controlled by the additive counting of the respective delivered amounts by the single pump and it may be questionable through the lines(w,x). After the preprogrammed consumption of amount registration and alarm is effected through the lines(r,s). Also the consumption of cannulas is reported and registered through the counter after contact-countering at the contact(392) in the area of suction cup according the activation by the gear pin through line(t). Concerning to the construction of the sensor cannula the invention is supported by the following publications and by the publications cited there:

I. Implantable Glucose Sensor, E.Wilkens and M.G. Wilkens; J.Bio.med.Eng.1983,Vol.5,October,309-315.

2. Problems in Adapting a Glucose-Oxydase Electrochemical Sensor Into An Implantable Glucose-Sensing Device, Daniel R.Thevenot, Diabetes Care,Vol.5 No.3, May - June 1982, 184-189.

3. Progress Towards an Implantable Glucose-Sensing Device, David A.Gough, John K.Leyboldt, and John C. Armour: Diabetes Care, Vol.5 No 3, May - June 1982, 190 - 198.

An electronical delaying of a renewed printing process may noted down with continuing transport of the registration belt to hold readible the printed out dates. More advantageous (by reason of the energy-saving) is the running after of the registration belt according the elapsed time during the use. It It is provided also a program automatic, to settle

evident wrong decision by the part of the physician, which again and again make necessary equal dosing corrections. Such a program automatic is also advantageous also than, if the life conditions of the patient change without the possibility to call on medical help. At short notice also the reasonable patient must become the possibility to vary the insulin doses within the free zone which is fixed by the physician. By means of the (lockable by the phycisian) key(586) the patient is enabled to add impulse-like or cycle-like supplementary immediately working insulin for the injection, so far as he carries out that within the next minute after the command. The absolute hight of the whole supplement dose known to be limited by the physician within the free zone which is narrowed anyhow.
For the commands, which limit the choice by the patient, is provided a separate control ring.
G.e.its position 1 means = Blocking of the program automatic (see below) for immediately working insulin, 2 = Blocking of the program automatic for retard insulin, 3 = Blocking of the entire program automatic, 4 = Limiting of the supplement dosing upon 15 cycles, 5 = limitation upon 10 cycles, 7 = Blocking of the supplement doses, 8 = limitation of the supplement dosing upon 15 cycles and blocking of the program automatic for the immediately working insulin, 9 = Limitation of the supplement dosing upon 10 cycles and blocking of the program automatic of immediately working insulin, 11 = Blocking of the supplement dosing and of the program automatic for immediately working insulin, 12 = Limitation of the supplement dosing upon 15 cycles and blocking of the program automatic for retard insulin, 15 = Blocking of the supplement dosing and of the program automatic for retard insulin, 16 = Limitation of the supplement dosing upon 25 and blocking of the entire program

automatic etc. A decode disk(595) is affixed on the lid of the device, whereby that is revolving suitable as control ring itself. Relating to"Program automatic" an installation means . which performs a correction of wrong decisions for the compensation of dosing. If is called off four times successively with the same time-block, so the retard insulin dosing is increased in each case for 1 cycle for the time point, which walk ahead to the measuring time points. If the programmed correction dose reaches the adjusted maximal value without full compensation (if also a additional injection is requested from the block V), so the retard insulin dosing of the preceding time block is increased by 2 cycles. The increase is effected within each time block now on each occasion after measuring. If the lower limit for the dosing correction fell short during anyone use of the device, so a shortening of the retard insulin dose results for the time block, which preceeds to that time point. When the lowest limiting value for the dosing stop is reached, so shortening of 2 cycles results, so far as the supplement programm V isn't activated during the elapsed two hours.

To activate the program automatic for the immediately working insulin the cooperation of the patient is necessary. By the operation of the program button(597) the allotment by the time block is disengaged and called on block V, as far as an injection of retard insulin not resultet during the last 6 hours. The patient shall taken on a meal with 3 bread units of hydrocarbons, which are readily to resorb, about within 15 to 20 minutes before the button is pressed and it is requested that he effects the controlling measurement within 15 to 20 minutes after the dosing of immediately working insulin is resulted, the hight of which relates to the preprogrammed correction prdgram. If the measured-(actual)-value exceeds the ideal-(nominal-) value, so the dosis-correcting-factor(K2)

is increased for 1. If the actual value falls short of the nominal value more than 20 milligram percent, so the dosis-correcting-factor(K2) is lowered for 1. By the display the patient is called on in all cases of correction to repeat the testing of program some time. The state of the real position of program (deviating perhaps from the starting position, which is readable by the position of the control rings) will be rendered visible by a little turning-motion on the controll rings concerned upon the classed field of display. The physician is able to render visible the altered values of programs also by the position of the control rings by readjusting of the control rings after these are spaced back beyond zero (whereby the both contact pegs of the switching ledge(371) are activated simultaneously that the edge ring(316) which is supported to each control ring(372) is revolving arranged towards the prior, whereby the extent of the movability or clearance is limited by the blocking peg(275), which inserts from the edge ring through a slot on the carrier-ring to a distance downwards of the interval of the singular stops of the snap-in ball(373). The sliding contact(226) at the wave-summit of the inner profile of the control ring meets the contacts(598,599) of a switching ledge on the housing cylinder(315) and closes the contact towards the control unit. The reset-spring (600) between the edge-ring and the control ring interrupts then again.

It must be distinguished according the activation of the program automatic for immediately working insulin, wether the adaptation of the correcting factor for program V to the relations of metabolism is proposed (and this kind of correction have been represented above) or the preprogrammed amounts of immediately working insulin of the singular blocks should be altered. The correctional last supplement dosing of immediately working insulin in addition to the doses of retard insulin (exceptionally also the dosing of immediately working or unmodified insulin alone)
is effected automatically, if the patient applies again the injector 15 or 20 minutes after the injection (So far as correction is not blocked).
Description of the program operation:
In the loop of the main-program(MP) is questioned, if the cannula has skin contact(1), so that the measuring may begin, or if the clock-time(2) of a active time block is reached, so that the user must made attentive (by alarm signal),
wether the user desires(3) a displacing(8) of the time blocks, wether(4,5) one of the supply container must be charged(9,10) to the value of a new container(Fig.59).
The operation(12) of the intern clock and of the controll ring contacts(13) is so time critically, that it interrupts the main programm if needed Fig.60).
The Fig.61-64 are a refinement of the block(6).
After the measuring(14) is decided, wether the program automatic for the instantly working insulin should be effective. If that is not the case and the time not lies inside of the time window(20) of teh programs I-IV and the user not pressed the buton(21) "program V" during the next 15 sec.(23) or if of course program V is selected, but the blocking time after the last injection is not yet transgressed(22), so the process is brocken off by reventilation(18,19) (Fig.61).

If the choice(24) between two programs is possible, than the position of the switch for program choice is questionded, unless it was taken a decision at the same day. If the measuring value lies not in tolerance window, so a correction(27,28) of the insulin doses is effected. If the measuring value is transgressed the function blocks 27,31 to 35 follow. Besides the program automatic for retard insulin either 29,30 or 31 to 35 is effective, unfollow. Besides the program automatic for retard insulin either 29,30 or 31 to 35 is effective, unless it was locked(29,31) by the physician(Fig.62). The injection events after 15 sec.(41), if the user not activates the key or button "waiting". A twice repeated pressing(37) of this button effects the break off(42,43) of the injection. With button "+" and "-" the dose of instantly working or unmodified insulin may be altered(44,45,46). In the case that the supplies resting after the injection are not sufficient(for an injection with full dosis, the user will be invited to pump(56,57) the differential quantity into the supply container. If, during 15 sec. not any button is operated and the skin contact still exists and the insulin supply is sufficient, the injection will be performed; in the other case the interruption by reventilation(51) will be effected. If the skin contact continues inadvertently,the device remains in an attending position(52,Fig.64).

Figure 65 is a longitudinal section of an embodiment opersated by spring action, wherein a hose roller pump is employed as dosage device. A mounting plate(4) above the fixing tab or tongue(3) is attached as outer support or abutment for an exchangeable or replaceable cylindrical vacuum reservoir cuplet(5) at the housing cylinder(1) above the covering plate(2) closing said housing cylinder. It has a cover in the form or a membrane(6) about the aperture conus of the cannula located at the center of the rod or pin(7) and extending further with its free end(8) in the shaft of the cannula, which end is surround or enclosed by the annular piston(9). The border membrane(10) divides the cuplet into the space of vacuum reservoir(11) and the suction cup(12) while comprising the predetermined breaking grooves(13). At the mounting plate(17) the support ring(15) is affixed by means of four screw pins(14). On the opposite side of the housing cylinder above the base(16) the base plate (17) is mounted parallel to said support ring (15) and to the mounting plate, which mounting is effected by means of a slide-in or plug-in locking mechanism(18). The base plate supports the container cylinder(19) having a lateral slot for inserting the drug or preparation supply bag(20). A cam engages across the angle bracket(21) from the base plate into the longetudinal groove(22) of the sliding sleeve so as to prevent it from being rotated. A tang of the dosage disk(25) effects in the sliding sleeve (23) thereoff its rotary motion. Clamping pins or setpins(26) are uniformly spaced about the circumference of the dosage disk, wherebetween spring steel tabs(27) are locked at the tripping pin or rod(28). The drive of the dosing disk(25) for displacing the sliding sleeve is transfered via the tube segment(29) onto the disk with

detent(30) and onto the spiral spring(31). The detent or pawl(30) acts upon the pawl wheel(32) on the tubular collar(33). The pinion(34) mounted thereto actuates the counter, engaging the gear rim of the counting wheel(35) located behind the plane of the projection and held by means of a compression spring(36) against a supporting lamella(77) at the housing cylinder. Spring-suspended pins or rods on the counting wheel(38), the compression spring(39) of which contacts the supporting wall(37), effect that the counting wheel(38) is rotated via frictional contact with the pinion; an escapement on the supporting lamellas(77) allows vea the actuation by a tripping pin onto the counting wheel(35) but one rotation respectively about one of a hundred teeth in the counter(78) after the counting wheel (35) has effected one revolution. The exhaustion of the drug or preparation supply is approached, a spring suspended pin, which has a divergent central spacing, snaps into engagement with the bore of the pinion an blocks also the rotation of the dosage disk(Fig.70). The force of the spiral spring(31) is transferred across the tubular collar(33) onto the carrier disk(40) for the axes of both rollers(41). These rollers are urged by two speres housed respectively in two tubular sleeeves againsts the hoses(44), the recessed ring(43) serving in this conjunction as abutment which comprises a gab thereunder for the passage of both hose legs of shanks. In this section the hoses are coated up to the T-member(46) comprising the cannula attachment piece(47) with inextensible envelope(45). The hose ends are stretched by means of tension springs(48) at locations where the emerge from the pump. The pumping unit is displaceable along the sliding sleeve on the tubular collar(33) against the action of the compression spring(49).(The appropriate pin or rod orginating from the carrier disk(40) in the asso-

ciated cross slots in the tubular collar have not been represented in the drawing). The sliding motion is carried out by means of four vibrator pins(50) arranged on an annular prism profile on the exterior of the carrier disk (Fig.72). These vibrator pins are flush mounted in the disk(51) being rotable independently of the tubular collar and engaging with a cam, the spiral slot of the axle driving shaft (52) at the free end of which there is located a foot plate(53), and at other end of wich there is mounted a cam pin or follower(53) engaging the longitudinal slot of the sliding sleeve and preventing rotary movement of the axis or shaft. The spiral spring(55) serves the purpose to drive the disk(51).

Figure 66 is a cross sectional view along line A - B of Fig.65, showing the mechanism of the dosage adjustment. Three spring steel tabs(27) originating from the disk rotable on the tube segment(29) are disposed between clamping or setpins(26). One of the spring steel tabs contacts the tripping pin(28) for dosing after having passed the wedge profile ridge(56) of the release mechanism for reventilation(Fig.68). Two of the spring steel tabs represented are disposed in a type of blind or blank zone of the rotary sector of the dosing disk(25), as resulting from the necessity of supporting the spiral spring at the housing cylinder(1) and from the feasibility of manufacturing the slots in the sliding sleeves(23).

Figure 67 is a cross-sectional view along leine C - D of the dosis counter indicating the consumption of the drug or preparation, and the locking means for preventing the use of the injector subsequent to the exhaustion of the

supply of the drug or preparation. The pinion(34) is mounted on the tubular collar(33) for driving the counting wheel(35). A cam pin or follower mounted thereon actuated, after respectively one revolution, the spring-suspended locking escapement or armature(57) effecting continued rotation of the large counting wheel(38) to the extend of width of tooth under influence of friction of the pins recoilable by means of leaf-typed springs. One of these pins has a different spacing to the toothed wheel center and is pushed by means of compression springs(39) into a bore of the pinion (34) as soon as counting wheel(38) has carried out one complete revolution, which corresponds to the exhaustion of the supply of the drug or preparation.

Figure 68 is a tangential sectional view along line E - F of Fig.65, showing the releasing or tripping mechanism for reventilation and for dosage dispensing subsequent to vibratory action. The spring steel tab(27) has surmounted the wedge of the wedge profile ridge or ledge(56) at the point in time illustrated. Said ridge or ledge had been returned by means of compression springs (64). The slot guide(65) with the slot pins prevents that they will slide off laterally under the action of the leaf-type springs(63), permitting the ratchet rack(62) to engage the ratches of the small toothed wheel effecting thereby its revolution. Co-revolution of the large toothed wheel(58) connected to the small toothed wheel has the effect that the saw teeth thereof engage the sliding pin(59) in a slot of the release or trippingbar at a point in time when said bar is raised(as shown).

To the right of Fig.68 a disk(51) is shown in an enlarged scale of 2 : 1. This disk carries the vibrator pins. The illustration is shown in greater detail so as to give an appropiate presentation of one of the four passages or penetrations

wards (and with its position later on). The rammer extends further through the passageway(70) into the drum(71) which is provided with the depressed connnecting link guide(72) into which the fixing screw(73) of the terminal plate(12) projects. The housing for the drum has been omitted for the sake of clarity, just as the housing for the wedge(75) for blocking the vibrator pin(50). A cap or cover(76) is placed on said wedge, which cap is elastically hinged and lets the the vibrator pins pass when the disk rotates clockwise however, not the case when the rotation is counter-clockwise. Said wedge is provided with an oblique slot(77) for accomodating a wire stay or strap(78) the square axis of which is rotable within the pivot bore(79) of a slot in the spring-suspended connecting pin(80). The tripping notch (86) in the shaft above the drum is turned away, corresponding to the position of the fixing screw in the connecting link guide, from the transverse pin(87) of the wedge, whicn action is even reinforced when the drum is raised and rotated alongside of the connecting pin guide, When urging the vacuum reservoir cuplet all the way up, the feeler angle pivots about 90 degress and comes to rest on the rim of the pin(7) about the shaft of the cannula. A lowering of the drum is thus prevented. The rammer rotates, likewise, and takes up its place now, turned onto its narrow side, laterally of the wall of the cuplet, coming down by passing thereby. The tripping or release mechanism for reventilation is comprised of a tripping bar(60) having a compression spring and of a bay(88) preventing rotation and disposed between a mandrill(89) guided in a bushing and an attachment underneath the drum(71). In contradistinction to the illustration of Fig.68 the sliding pin(59) is not yet in rest position within the tripping bar(60).

(67) into which the round dome of the tripping pin(28) may escape under the influence of the oblique positioning of the spring steel tab to order to be returned onto the disk surface via an obliquity and after passing the steep flank. In this manner, the movement of the dosing disk up to the stop of the next spring steel tab has been unblocked.

The Figure 69 is a simplified view in cross section along line C - H of Fig.65, showing three back-up buffers(81) being both guided by means of a spring steel stay(82) towards the wall of the vacuum reservoir cuplet and being pressed by means of the compression spring(83) against its projecting rim. A pivoting lever(84) is employed for removing again the cuplet connected in this manner. This lever(84) forces a wedge in between the mounting plate(4) and the cover membrane(6), which will become more clear when inspecting the partial longitudinal section shown below said cross section.

Figure 70 is a view in cross section taken along line J - K encompassing the center of the vacuum reservoir cuplet towards J. It shows the mechanism for tripping the vibration means and the tripping or release means for reventilation of the vacuum reservoir cuplet. The abutting or support ring(15) is constructed in this connection as modification to a conductor cylinder leading upward so as to facilitate the introduction of the vacuum reservoir cuplet. Said ring is provided with a lateral slot(68) through which a flattened loading stick or rammer(69) reaches down. The broadside thereof is shown in the illustration, with the lower edge of the wall of the vacuum reservoir cuplet(5) being supported while the feeler angle extends rear-

In Figure 71 the cross section taken along line L - H in Fig.65 shows the position of the hose between the rollers(41) and the grooved ring(43). A sectional view through the dosing disk(25) in the direction of the arrow shows thereunder its profile cavity for accomodating both hoses.

In Figure 72 the projection shows the vibrator mechanism of Fig.65, wherein four vibrator pins(50) effect, on the disk(51) with its revolving motion relative to the wedge profile ledge or ridge(56) of the dosing pump, their jerky displacement against the compression springs(49).
For the device to take up its operationin keeping with Figures 65 to 72, the plug-in or slide-in locking mechanism(18) is drawn, whereupon the shaft can be drawn out from the sliding sleeve. The injector is then disassembled into a right half comprising the covering or terminal plate (2), mounting plate(4) and screw pins(14) together with the support ring(15), the pump unit inclusive of the grooved ring(43) may then be drawn off from the tubular collar(33). After bending out the ring(43),the hoses in the profile cavities of the dosing disk may be slidingly introduced and the emerging ends of the hoses may be connected up to the tension springs(49) at the onset of the envelope(45). The drug or preparation supply bag(20) is introduced into the container cylinder(19) via the slot provided thereon. Said cylinder is with its attachment part of the left injector half which must be approached once more by assembling the component parts. (The detent or blocking pin- which has not been incorporated in the drawing- must be inserted in its longitudinal slot in the tubular collar(33). The cannula adapting or attachment piece(47) is plugged through the bore of the attachment plate, closing, in the end, the plug-in or slide-in

locking mechanism(18). The dosage is then preselected by slightly raising the spring steel tabs (27) and rotating them in the interventing space between two clamping pins(26) each, which space being designated by numerical markings.

By exerting pressure on the foot or base plate (53) at the end of the shaft(52), e.g. on a table or squeezer plate, the disk together with its vibrator pins(50) is moved across the wedge profile ridge or ledge(56), the cap(76) letting the vibrator pins pass by reliliently avoiding them, doing so up to the highest tension of the spiral spring(55). The movement cannot be reversed on account of the presence of the wedge(75). By exerting pressure on the sliding sleeve(23) the spiral spring(31) is loaded, without this movement being transferred to the pump by virtue of the detent or pawl(30). The spring steel tabs slip -elastically evasive by virtue of the obliqity of their ends -over the end of the tripping pin(28) and the wedge profile ridge or ledge(56), with the spring steel tab -locked by the tripping pin- for the first dosing comes then to a halt in front of the tripping pin by pushing back the wedge profile ledge which can be displaced only inwardly towards the compression spring(64) after the tripping bar(60) has been raised, the notch of which unblocking the movement of the large toothed wheel(58) via movement of the sliding pin. This comes about after a vacuum reservoir cuplet has been inserted by raising the rammer up to its rotation about 90 degrees of angle above the connecting link guide(72) on the drum. The notch(86) circumvents -by overtaking- the transverse pin(87) to come to rest thereabove on the shaft above the drum. When effecting an application and setting the support or abutting ring(15) down on the skin, the annular piston is raised, by exerting heavy pressure on said pro-

compression springs from the edge or end slot, blocking its motion and comprising a terminal arm parallel with wire strap. into the pivot bore(79) and drawn out laterally from the oblique slot (77). By the way of the slot guide (not illustrated in any particulary detail) which is devised so as to be more and more restricted and located in the connecting pin it is assured that the retaining clip returns when compressive-load is applied to the perpendicular line(Fig.70). Subsequent to exchanging the drug or preparation supply bag the counter has to be reset to zero. To this purpose, the counting wheels(35,38) may be respectively unblocked antagonistically from tooth wheel engagement against the compress ion springs associated therewith, whereupon they can be freely rotated.

Figure 74 is a schematic diagram at a scale of 2 : 1 of pairs of antagonistically operating rollers(41), the outer counter rollers(90) in this example are edling and rotated passively, an operation facilitated by their rubber elastic surface. Two rollers each are attached by axes to a common pivot arm(91), the drive being effected via a pinion turning on a larger toothed wheel (92).

In Figure 75 showing a full size schematic sectional view from above (somewhat in the direction of the arrow towards Fig.74) a dosage pump is illustrated. It is shown here a feasible manner of hose lay-out with a hose pair while using roller pairs as in Fig.74, both of which hose legs departing laterally and thus solidely contacting the carrier disk(40) in that herebetween a toothed wheel is disposed having notches between which threads(94) bridges over both hoses(44) in a rope ladder-type manner.

Figure 75 is a modification of the embodiment shown in Fig.65 to 74, the difference over said

jecting annular piston, to an extent such that the predetermined breaking lines(13) of the border membrane(10) will break, whereas the suction cup rim will already close off the skin about the suction cup. The negative pressure effective from the reservoir raises the skin into the suction cup, and at the same time, hoever, the pin approaches the skin(Fig.88), which has lost its support about the cannula shaft, whereby the feeler angle(74) reduced and the tripping notch(86) can evade into the transverse pin(87) (Fig.70). This comes about under the trust of the vibrator pin contacting the cap(76). The wire strap or stay(78) being under the tension of the connecting or locking pin (80) penetrates then into the oblique slot(77) and effects the return of the wedge(75) into locking position before passage of the next vibrator pin. Subsequent to the thorough mixing of the contents of the hose in the pump range by way of vibratory motion the tripping pin(28) transcends the steep flank of the opening or passageway(67) in the disk(51), thus cancelling for short period of time the blocking of the spring steel tabs(27) and initiating the injection action. Subsequent to the transcending the steep flank on the wedge profile ledge(56) by the following spring steel tab a sectorial rotation of the lasrge toothed wheel is unblocked under the effect of the compression spring(59) receding, the tripping bar is lowered under spring action, while the mandrel(89) penetrates the cover mem- of the vacuum reservoir cuplet for the reventilation thereof. With respect to the wire stap or stay(78) described above it need be pointed out that, during the lifting of the connecting pin (80) in the terminal phase of the lifting operation of the rammer(69), it is drawn down by frictional connection at the support plates for the

former embodiment relates to the type of construction of the start mechanism for dosing. The schematic diagram shows the upper portion of a vacuum reservoir cuplet comprising an elastically closed window(85) in the rigid cover membrane. According to the position of rotation of the locating screw or pin in the connecting link guide of the drum(71) the rammer(69) with its broadside faces the wall of the cuplet and has sagged past it. The bellows(96) being stationary relative to the drum on acount of axis(95) are, in common with and parallel to the pneumatic cylinder(98), attached or connected to a gallows frame or girder(97), the piston of which cylinder constituting at one and the same time the rod of the slide valve(99). The slide valve, being open toward ambient atmosphere, is connected via line(100) and an open nonreturn valve to the bellows. A line(101) connects from the bellow a closed nonreturn valve to a pneumatic cylinder which is connected via line(102) to the -here and now- closed opening of the slide valve. The present position of the slide valve results from the valve rod together with the elastic membrane of the window (85) having been raised, because the negative pressure attracking the membrane became weaker on account of the pressure compensation during the action of raising the skin in the suction cup. If, when inserting a new cuplet, the loading rod or pin is raised, the bellows are compressed by having the air evacuate via line(101) and actuate the pneumatic piston. In this respect, its rod is lowered into the window(85) and the excessive pressure in the pneumatic pump is evacuated via line(102). It is not possible for the bellows to unfold and for the drum to be lowered by rotating and actuating the release or trip for the dosing means(75) until the line(100) is again ventilated by slightly raising the valve rod by means of the window membrane.

In Figure 76 a very schematic presentation of the stages of functioning or operation A - D shows a modification of the mechanism for reventilation the suction cup, as is suitable for devices which cannot -as shown in Figure 75- be reventilated as by destroying the cover membrane of the cuplet. In this example, the sliding valve(99) as a whole is slidable on the rail(103) against the action of compression spring(104). The valve rod(106) of wedge profile to be e.g. actuated by a spring steel tab(27) comprises a separate compression spring(105). The air or ventilation hose(107) is connected to the slide valve in the suction cup chamber; this being most readily done with the suction cup forming part of the injector(Fig.77). A rocking or seesaw-type stop slide or valve(108) is actuated lengthwise of a linke at the valve rod. In stage A the valve rod is on the left, the slide valve is closed and during injection for this condition on the right hand. In stage B the slide valve has been slid to the right, and is still closed, In stage C, the slide valve in the right position is still held by the stop slide or valve, while the valve rod is slid towards the left under the action of its spring, and opened thereby. During this sliding motion of the valve rod, the return motion of the slide valve as a whole is tripped by way of its spring(104) by actuating the stop slide or valve. In stage D the condition of stage A obtain again.

Figure 77 is a longitudinal section of an injector whose dosage pump comprises a collar(107) of cup-type construction and elastic material. This collar is fixely mounted on a rod(110) comprising on its surface a wound grooved recess in the form of a bore for the passage of the drug or preparation. The rod has its lower end housed within the

cannula attachment piece(47) and its upper end in the terminating neck of the pump housing(111). On the top of the rod terminates in a pierced plate or or disk(112) for the passage of the drug, which disk expands the hose(44) at this location, thus bridging the section between the drug supply bag constituted as bellows and the terminating neck of the pump housing. The collar(109) faces with its cavity the annular plate(113) attached to the pump housing which extends, furthermore, into a downward conically tapered, elastic and centrally pierced stop or plug(114). Underneath said plug, the rod supports the annular valve plate(115). The pump housing is slidingly inserted into the bush(116) of the central axis, about which the component parts for the actuation of the pump are rotably mounted. Said bushes extends to the exterior into the housing cylinder(1). On the bottom thereof the wheel(117) is journalled in a ball bearing, the annular wedge profile ridge or ledge(56) pointing upward and resembling in its functional mode and its configuration the vibrator means of Figures 65-73. Instead of the pin with its terminal ball or sphere enhancing slidability, in this instand three rollers uniformly spaced over the circumference thereof (only one of which rollers is shown in the drawing) are attached via axle pins underneath the external lower rim of the cylinder(119) having bowl-like (double-walled) jacket, the interior wall of which can be slid on the axle bush, yet it cannot be rotated. The compression spring(121) is mounted between the border ring of the twin cylinder and the annular plate(120) attached to the axle bush. Three circumferentially spaced angle plates or elbows extend from the upper border of the twin cylinder through the slots in the axle bush to a location laterally above the plate or disk

(112) in order to engage there the head notches in longitudinal locking slots of the border segment of the locking sleeve(123). The latter transmits the motion of thrust or impact of the rollers(118) from above onto the plate or disk. The annular plate(124) is also fixedly attached to the axle bush to be followed on a ball bearing by a rotatable wheel(125) having a wedge profile ridge or ledge which is directed downwardly.Three rollers face said wheel on the external cylinder(126) slidably mounted in vertical direction towards the adjacent inner wall of the housing cylinder. The annular plate is acted upon by the compression spring(127) braced against the bottom of the housing cylinder(1). The wheel(125) is composed of parts having divergent boundary diameters. The upper part supports externally a rim of locking teeth engaged by the detent or pawl (128) attached to narrow annular disk(30) about which the external face of the annular plate(124) can be revolved. The revolution or rotation of the spiral spring(31) is communicated via the bridge angle(129); said spring being capable of being biased in a manner such that the wheel(125) is not rotated therewith. After reversal of motion the movement of the spiral spring is communicated via the detent or pawl to the wheel(125) and from here via the intermediate cylinder segment(130) connected between wheel(125) and wheel(117) to both of the wedge profile ledges. The pendulum movement of the outer cylinder(126) is transmitted via three U-straps(131) housed in the bores of the axle bush from below to the plate or disk (112). The container cylinder(19) is screwed by means of internal threading onto the mounting plate(4) and supports a guide bushing(132) for the rectangular bar(133). The lower pinion(134) attached therto engages the correspondingly con-

structed toothed rim of the lower part of the wheel(125), the upper pinion(135) being slidable on the rectangular bar and engaging the toothed rim between the projecting disks(136,137) of the cap or cover(138). Said cover has been provided with an external threading to be screwed into the internal threading of the container cylinder(19). The bore(140) suitable ventilates the inner chamber of the container via the bellows.For the upper pinion to penetrate through the container cylinder a slot(141) has been provided therein. Screw bolts(142) slidable in the slots of the container lengthwise of a scale permit that the residual amount of the drug -which corresponds to a corresponding height of dosage- is determined before new bellows are used, and this by preventing by its stop the cover(138) from being lowered still further onto the screw bolt.

The illustration in Fig.77 shows on its left the state or condition prior to and on its right the state during the use of the injector for carrying out the injection. The support or abutting ring (15) extends further into a cylinder provided with a sliding ring(143) to the accomodating cylinder(144) for the vacuum reservoir cuplet(5). The ring(145) atttached to the accomodating cylinder is used for attaching the rubber elastic collar(147) supporting the suction cup rim. It comprises, moreover, the guide slots for the release or tripping pins(148), and is used for attaching the release mechanism so as to provide for the suction effect on the skin. Inserted into the notch or recess(150) of the annular piston (left side of Fig.77) are, to this purpose, the three locking lamellas(149). By rotating the annular disk(151) in having the angular and bayonet-type tripping pins while raising the rim of the collar(147) the locking lamellas are moved

similar as the lamellas of the central shutter of camera to leave the notches of the annular piston -which is facilitated on account of the obliquity of the notches -so as to have the annular piston displace itself under the influence of the negative pressure between the skin and the vacuum reservoir chamber upwardly up to achieving equalization of pressure. The boundary membrane(10) is stretched in this way. The suction cup rim, being urged by said from the sides of the resiliency of the tripping pins, to start with, against the skin itself, is raised to an additional extend with the aid of the support ring. In this connection, the upper margin of the cylinder(151) actuates the rocking means(152) against its compressing springs, the pin(153) being drawn from a lower wedge profile ridge or ledge of the lower wheel(117) and tripping in this way the rotation thereof as well as the dosing action.

The mode of operation of the tripping pins(148)is schematically illustrated in Figure 79. The control ring(154), rotatively journalled by means of three head screws(155) at the ring(146) in slots, is retained by means of the compression springs from the points of attachment(145) on the ring in the terminal position. As can be seen when inspection said schematic sectional projection the bayonet-like bent tripping pins(148) abut with their oblique side a slot in the control ring. When the tripping pins are raised, the control ring is initially urged in stage B under tensioning of the compression springs towards the left. When lifting further in stage C the control ring contacts or abuts the tripping pins such that the return action of the compression springs upon the tripping pins is not effective. The first phase of return comes about due to the elasticity of the collar to which they are connected. The locking

lamellas(149) are retained, opposite their functional side of locking, held by the head screws (153). A secondary axle pin(158) connects them rotable to the control ring(154).

Figure 80 illustrates schematically a mechanism for reventilating the suction cup via hose(156). Said hose passes along in slot(157) of the cylinder of the support ring. The associated sliding valve(199) is actuated by a sectorially disposed delay mechanism. with the motion of the manual lever(161), comprising an upwardly directed moment of motion about the dosis indicator disk (159) by means of a resilient tongue or tab rotable by means of a tubular segment, the valve rod(106)of a slide valve is displaced against its compression spring insuch a manner that the opening of ventilation to the hose(156) is closed since the pump cylinder is affixed to the dosis indicator disk. The manual lever must now be lowered in order to pass the steep flank(162) of the conneting link ring below the mounting plate (4). To this purpose, the follower pin(163) withdrawn into the bore(160), thus keeping the return movement of the valve rod locked so long until the manual lever has once again passed the steep flank subsequent to returing to the O-position. The follower pin leaves then, by virtue of the elasticity of the manual lever, said bore, and the compression spring(105) is then capable of opening said slide valve again for reventilating the suction cup. Across the bridge angle(129) there exists a rigid connection between the dosis indicator disk(159) and the pawl(Fig.78). Stage A in Fig.80 designates the condition or state prior to the actuation of the manual lever when the slide valve is open. Stage B designates the state or condition slightly prior to the return of the manual lever into O-position when the slide valve

is closed.

For taking up the operation of an injector according to Fig.78 to 80 the square bar(133) is initially released from the lower pinion(134) and withdrawn from the guide bushing(132). It is now possible to unscrew the mounting plate(4) therefrom. While turning the bellows the connection between the locking sleeve(123) and the elbow (122) can be freed and the pump housing(11) with the cannula attachment piece(47) can be withdrawn upwardly from the axle bush. The cover(138) is unscrewed downwardly out of the container cylinder. A new pump housing is inserted and, by means of turning the locking sleeve connected adhesively in the manner of a thread to the bellows, the locking action with the elbows is carried out. the upper pinion(135) is slid between the disks (136,137) of the cover and thereupon onto the square bar subsequent to the container cylinder (19) being screwed again onto the mounting plate. The square bare is reinserted into the guide bush after the container cylinder(19) has been screwed, prior thereto, to the mounting plate(4). Now, a vacuum reservoir cuplet is taken from the steril packing and inserted under pressure against the bottom cover(165) (Fig.84) into the accomodating cylinder(144), with the guide grooves assuring the correct radial adjustment inasmuch a sthere is correpondence of their cams(167) in the guide cylinder. Prior to the passage of the locking lamellas the tripping pins(148) must be briefly actuated. Once the locking lamellas have registered, the bottom cover is removed; in any case prior to injection. By turning the manual lever (161) the slide valve is closed for reventilating the suction cup and, subsequent to slightly pressing the manual lever, said lever is displaced further in keeping with the dosis to be selected by counting the stopping stages of the pin(153)

along the locking tooth profile ledge or ridge. The dosis set may be controlled by vitue of the position of a marking on the dosis indicator disk with respect to the scale on the container cylinder. If the support ring(15) is set down on the skin, said ring can be raised only when the direction of thrust is strictly vertical, otherwise the accomodating cylinder will jam. By way of raising the suction cup rim at the collar(147) the tripping pins(148) are effected to be raised and the locking lamellas to be withdrawn from the notch of the annular piston(9) which is raised together with the skin. The lifting action of the suction cup rim continues until the rocker(152) is actuated and until, hence, injection is initiated. Said injection is performed at equal surges or bursts of the fluid in keeping with the pump motion of the collar(109). When said collar is urged with its border against sthe annular plate or disk(113) an amount of fluid -by being sealed thereagainst as well as against the inner wall of the pump housing- is sealed off under its border wherefrom a certain amount, measured commensurate with the segment of motion of the valve rod, is ejected in the direction of the cannula since the valve (115) has moved away from the lower plug surface, This point in time is represented in Fig.77. The rollers are upright, at full depth, in the depression or recess of their wedge profile ledge; the contra or counter rollers on the outer cylinder(126) ar upright, at full height, on the summit of the wedge profile ledge. The valve plate(115) is carried to distance from the plug by means of lowering of the rod(110) and the collar(111) approaches with its rims to the annular plate(113). If the collar has been descended furthermore, a certain quantity of fluid will be expelled towards the cannula. But before the collar lifts off again from the annular

plate, counter-moving, the valve plate has closed again the opening of the plug (in keeping with roller guidance).

Figure 80 is a longitudinal section showing an injector with electro-magnetic dosing pump similar to this of Fig.77 which is integrated into the hose, whereby a roll of tightly piled-up sheeting or foil, piled-up with chemicals, assures a gradual release of gas within the container during a control by an relief pressure valve and in that a steady pander-to of drug or medicine; the negative pressure is produced by three boilers which can be be separately opened and must be electrically heated before injection. In Figure 81, besides, the loops(191) at the cannula attachment piece are shown inside of the suction cup with rubber-elastic rim and an inner lip, thereabove the large(168) and small valve piston (169) of the dosing pump with rod(110) and pierced plate(112) inside of the hose are shown. About the plate(112) lay the resilient clamping jaws(171) which are moved by means of the solenoid(170), resilient by spring. Between boiler and solenoid lies the insulating jacket(177) which, here and there, also surrounds the hose (44). The drug container is fastened by the fixing bolt(195) and the fixing screw(194). On its cover(138) the relief pressure valve is mounted and inside the folded bellows(20) with the drug and the roll(182) for gas production. To safe against rotation there are the brackets(190), while the control cylinder(188) with ball bearing is rotable towards the container by its peg in keeping with the retain-groove(193). Cable connections or terminals(176) lead from the control unit towards the solenoid, towards the resistance wires, towards the start contact(197) and towards the sensor cannula. The resistance wires(178) ex-

tend between insulator rings. The folded bellows (20) with drug is mounted inside the container cylinder(19) sealed by tightly screwing the cover (138) thereto. Between the mounting plate(4) and the hose the seal(196) is located within the passageway for that. The bellows contains in its central bowl-like depression a rolled-in solid state package or roll(182) for generating compressed gas. Tension springs(183) extending obliquely through the chamber are attached at the locking pins of the valve flaps(184), which pins being guided through the bores of the obliquity of the suction cup. Excentrically exterior to the gasket ring of the valve flaps, these flaps are respectively reached by an upright rod(185), sealed upstream of the control ring(186). They are met by tripping tabs(187) reaching downward from the control cyllinder(188) and capable of actuating a rod only respectively after each third lowering of the control cylinder through the control ring. It is a prerequisite herefor that the three tripping pins(148) are raised simultaneously within the suction cup.

For putting the injector in operation the brackets(190) are bent open and the container cylinder together with the pump unit up to the cannula attachment piece inclusive of an insulating envelope or jacket against thermal effects is withdrawn from the contactor or control cylinder. Setscrew or fixing screw(194) is loosened subsequent to the cannula being extracted at their loops(191) from the suction cup. After detachment from the locking or fixing bolt(195) the bellows, the mounting plate, the pump housing(111), and the insulating envelope in their entirety are exchanged; the clamping jaws(171) about the disk or plate(112) are to be closed before the pump unit

is again inserted into the contactor cylinder and locking is carried out. The heating boiler is heated up for a pretermined period of time via the lead to the mains( ), giving rise to heated air to pass off, via the valve flaps lifted by the overpressure against the action of the tension springs, into the suction cup chamber or space.
Figure 82 gives a cross section at hights A - B of Fig.81 which shows the distribution of the heating boilers(172) and their cross-walls(174) and the distribution of the heating wires(176).

The projection shoen in Figure 83 shows schematically the rotation of the control cylinder over a cam guided in sliding grooves(189). The schematical rolling-up or projection shows in a range of the control ring merely in raising all cones by the action of spring-suspended tripping pins is it possible to provoke a displacement to the left of the control ring and the effect of the compression spring, whereupon a tripping tab may penetrate into the oblong holes with wedge obliquity effecting the return of the control ring against the action of its spring. Due to the fact that the three tripping tabs and the nine oblong holes are spaced at the same interval the valve rods being distributed irregularly beneath the oblong holes, despite of the short turning moments, may be obtained that respectively one valve flap after the other is made to open up. The brackets(190) embedded in the mounting plate unblock the clearance of motion between the drug container or vessel and the remainder of the injector. During the last phase of the lowering of the control cylinder the start conctact(197) for the dosing automatic is operated. After the dosing is completed by means of the preprogrammed

pump strokes the reventilation of suction cup events by the opening of the magnetic valve(368) by means of impuls from the control unit. For the next two uses an anewed heating is´nt needed. If the rope(139) is made tightly the electronic alarm beneath the cover is triggered since the drug supply is nearly exhausted.

Figure 84 shows in longitudinal section a vacuum reservoir cuplet of the twin-chamber type which can be used in the injector of Fig.81. One of the three guide groove(166) is illustrated in said Figure, which necessitates even prior to the passage past the locking lamellas that a rotation of the cuplet is effected in a defined angular position. The cams(167) provide for this angular position in the terminal seat of the cuplet.

Below the Figure 85 just described there is shown in cross section along line A - B of said Figure the clover-type bulge or bay of the suction cup collar. The tripping pins(148) are arranged in the identation provided therein.

In Figure 86 a vacuum reservoir cuplet of the single chamber type is shown in longitudinal section. It is shown also a locking pin(204) orginating from the injector. The function of said pin corresponds to that of a locking lamella. The border membrane(10) is supported by the bottom ring of the support cylinder(205) having in its upper wall a kink towards the interior, constituting a space left for the passage of the thinwalled bulge(206). By means of the annular weld lining(207) the inner margin of the bottom ring of the support cylinder(205), the border membrane (10), and the center of the bottom cover(165) are bonded one with another. The rim of the bottom

cover abuts against the lower margin of the vacuum resevoir cuplet(5) and comprises at least one annular predetermined breaking line to be detached by tearing at a tongue when in the injector abuting said support cylinder on its rim has been taken over by the locking pins(204) of the injector up to triggering the aspiration or suction action relative to the skin. Part of the invention, and as an expansion thereof, is a socket belonging to the one-way cuplet so as to connect the elastic hoselet(209) issuing from the cannula attachment piece. The hoselet terminates in a small ball or sphere onto which negative pressure is transmitted via the shaft of the cannula. The clamp(210) is lifted to chec the negative pressure, whereby the ball is drawn inwards. After sucked-in the skin, the clamp can be lifted again to check whether the ball has filled up with blood. During injection the clamp prevents the drug or medicine to stream off into the ball.

Figure 87 shows in a crude schematic view the process of manufacturing of a vacuum reservoir cuplet as in Fig.(19)84. In stage A injection moulding of the cuplet and the annular piston is carried out side by side in conjunction with vertical separation of the mold parts(215,216). In stage B, e.g. the border membrane mode by means of three sectorially overlapping revolving conveyors(211,212,213), which membrane and piston are welded by means of an ultrasonic sealing head (214). The conveyer(212) transports the united parts to a press for asttaching the bottom cover and places them then under the opening of the vacuum reservoir cuplet. The united parts are conveyed into the evacuating chamber(217) for generating a negative pressure or vacuum by means of a compressor, and are then welded by the ultrasonic head(218) in the area of contact of border membrane and maginal ring(219).

Figure 88 shows a vacuum reservoir cuplet of type illustrated in Fig.65. It is disposed within the sliding sleeve(23) and is in a state for sucking in the skin.

Figure 89 shows at a scale of 2 : 1 a projection of the profile ridges or edges(225) on both of the wheels(117,125) in Fig.77. To facilitate comprehension of their mutual functioning they are been approached one to another.

Figure 90 is a schematic illustration of an electric buzzer, the alarm indicating imminent exhaustion of the supply of the carrier(221) thereabove, which carrier has a ring about the outlet of both hose shanks from a dosing pump of Fig.65. By means of the vibrations of the buzzer the hoses and the support or carrier disk(40) for the rollers of the dosing pump are also set to vibrate so that there is no need to incorporate a separate vibrator.

Figure 91 is a longitudinal section view of a modification of the dosing device of Fig.77, showing said device in greater detail. The hose(44) leading downward from the bellows(20) has a expanded configuration at the lower part of the space it includes about the rod(111). Yet another more extensive expansion of the hose replaces the pump housing and is encompassed by the axle bush (116). After the passage of the bore in the plug (114) the rod forms a valve cone(115). A sort of bellows is used as dosing chamber. The hose encompasses at the extended end the carrier or support plate of the cannula attachment or adapter conus (47), which can be regarded as being part of the plug-in or slid-in part.

Figure 93 illustrates the program block diagram for a control unit of an injector as illustrated in Fig.81 and 82 comprising of a Central Processing Unit(CPU),Memory Unit, and Imput/Output-Port

Figure 93 describes the program flowchart for a control unit of Fig.92.

The functions of the four keys are as follows:

Key 1 switches, when depressed, the contents of drug supply counter to display.
When depressed again, the safety reserve appears on display. Only after said second depression of this key do keys 2 and 3 perform their functions.

Key 2 increase the safety reserve.

Key 3 degreases the safety reserve if the supply vessel or container.

Key 1 turn off the display when depressed a third time.

Key 4 is closed when exchanging the insulin vessel or container.

In standby condition the processor enquires as to the state of the four keys and the switch (start contact 197). When the keys are depressed, the processor performs the display and modifies, possibly, the dimension of the safety reserve, as set out above.

The switch(197) triggers the injection. Hereafter the stroke counter is fed the value of the prorated dosage (e.g. there are storage modules for 2 to 20 piston strokes per four units insulin each) and, determines the frequency of the dosage pulse and, hence, the amount of fluid of the drug. After the injection has come to an end, a pulse is applied to the magnet for the slide valve(99) for reventilation the suction cup so that the device can again be released from the skin. The supply is up-dated and compared with the safety reserve and the prorated dosage. When the safety reserve

falls short, the alarm is sounded; however, the device continues to be operastive. When the preset dosage falls short (i.e. the supply of the drug falls below the single dosis to be dispensed), the alarm of alerting device is tripped, and the operation is blocked until a new drug supply reservoir has been introduced while key 4 is closed or stays lock during such time.

The Figure 94 shows in a longitudinal section a closing device for the medicine supply container effective until the supply is exhausted. Inside of the housing cylinder(1) a folded bellows as drug supply container(131) is mounted their drug hose (44) being located inside of the drug derivation tube or drain(316) with the supporting ring(601). This leans to the mounting plate(4) inside of which the locking cross-pins(330) clings outside to the springloaded detent bolts(329) with their (outern) tops, while the inner tops are engaged into the annular groove of the drug drain(316). The hose(44) continues downwards into the pump peg (337) with the cannula attachment piece; in the area of the hose rings(415, Fig.45-47) it is surrounded from the axle bush of the device. At the top the folded bellows are fastened inside the inserting cylinder(200) by means of spring biased locking lamellas and can be loosed through side slots. Provided that the befolded bellows are inserted together with the sliding cylinder after being fastened therein into the housing cylinder, the part of hose about the pump peg which is not enveloped contacts to the hose rings. The locking pins(330) engage (as shown in the Figure). If the drug is nearly exhausted the lower rim of the inserting cylinder goes down up to the detent bolts and sink these. The locking pins are now able to (retreat) from the annular groove of the drug

drug drain and the folded bellows can be drawn out again together with the hose by pulling on the rope(139) of the electronic warning device (387).

Figure 95 shows a variation of the dosage hydraulic. The separation piston(275) is mounted inside of a multidosage or stop syringe cylinder(272) upwardly to the drug, thereabove an auxiliary fluid is stored which has above a boundary cover piston(801) as a removable part. Thereto, the supporting piston(802) is set up which contains the cylindrical boring with the large(166) and small(169) valve piston which bore is emptied into the space with auxiliary fluid through a bore. A sealing is located between the folded bellows with auxiliary fluid, filled up by sinking the supporting piston under leaking loss, and the valve rod. The valve pistons are operated by the solenoid(413) by means of the valve rod and using the swivel or seesaw-like lever(803). The end of the valve rod engages with two arms shifted in phase into slanting grooves(803) on a disk. The latter is fastened on the threaded bar (905) which bears onto the threaded bush(805). For dosing a dosage unit of auxiliary fluid is pumped from the folded bellows into the space between the separation piston and the supporting piston. In that the supporting piston is supported downwardly the separating piston is displaced and thereby the drug through the cannula. During lifting of the valve rod (the bifucation thereof contacts different slant grooves of the disk at different phases) the disk is rotated and the threaded bar is lowered to this rate which corresponds to the displacement of one dosing unit. Thereby a repective amount of auxiliary fluid runs back into the folded bellows.

Figure 96 brings above a plan view, in the middle (and below) a longitudinal section along the line A - B of the plan view and below a longitudinal section along line C - D of the plan view showing a dosing device which is blown up by pressure of the solenoid(546).
This solenoid has its place over the short lever arm, which belongs to two respective plates(not folding in a hinge(547). Lever arms and plats do not cross at the end shown below, where the hose (44) is conducted out towards the cannula. When the flap opens -as it is shown- the discharge of the drug is blocked by pinching off between the short lever arms. At the place at which the drug hose is introduced the plats and the short lever arms cross like scissors, therefore the afflux there is unhindered. Between the plates the hose lies in a loop. When the plates are drawed near by magnetic effect of the solenoid the hose will be squeezed begining at the place of afflux the short lever arms working as springs and than in the area of the loop between the plates. The leg of the hose which leads back is conducted out through the break-through(549) to the surface of the upperst plate as to avoid the stopping of the discharge. The pressure spring(549) serves for the reset.

Figure 97 shows the hose(44) positioned in turns onto a spiral ring, which is coiled to a rubber pyramid. The counter spiral respectively lies above of the hose turns which are engaged and it is positioned inside of a cone-like cup. When it is sunk by the magnetic effect, the both spiral rings respectively keeping greater distance above as bellow are drowed near at first above as long as the hose is squeezed above. The hose is emptied downwards(towards the cannula) in a peristaltic manner. Whilst the conical cup

lifts up by the compression spring(549) the over-cup is lifted, first, the rim thereof squeezes the hose on its lower end.

The Figure 98 brings in a schematical longitudinal section a further dosing device as to drive by a pulsating operation. Piezo-electric transducers(564) which are driven by electrical voltage are positioned against a fixed upper-housing and lie on an elastic shroud ring(556). This contains an expanding part of the hose through which the hose continues over a lateral flattening of the shroud ring antecedent the rigid attachment piece(554) of the derivative tube or drain.to a blocking valve. The latter is freezed by the y the opening of the lid or cover of the injector as to interrupt the drug flow even when the piezo-elements are without voltage. The surface of the lentil-like flattened expanding part of the hose is firmly connected to a adhesing plate(567) which for its part is fastened at the undersideof the pressure transducer(564). Light guiding fibres lead from the light source of the left side through the shroud ring and are leveled at wall of the bubble of hose partial permeable for light. Opposite to the source of light inside of the shroud ring, light conducting fibres lead (below of the zone deformed by pressure) towards the optical sensor(561) which is optically connected as well with the control unit(176) as with the piezo-electrical switchs(562,563). By control of the switch(562), which is adjustable in height, piezo-elements get voltage causing its extension and the interruption of the drug flow at the area of the afflux of the swelling up part of the hose over its command-transmits. The dosing impulses now are changed into the stimulation and the extension of more parts of the pressure transducer, whereby the shroud ring is flattened

and narrowed in the lumen and whereby the swelling up of the hose will be reduced as long until the switch(563) recalls that the pressure transducer has the adjusted lowest level. When the voltage is changed as to extend the hose this will be filled up. Inside of the swelling up part of the hose, at first, a vacuum is generated by the sudden retraction of the pressure transducer (because the fluid dynamics is more inert). When the density is diminished and increased again by filling up that is answered back by the optical sensor to the control unit and the next dosing impulse is transfered to the pressure transducer before the drug is able to flow unhindered through from the container to the cannula. By the velocity of the synchronization of the particular parts of the pressure transducer (as a date word in the control unit) the speed of the outflow (respectively the distribution of the influence of the pressure over the time curve) may be controlled. By this means it may be possible to inject also through finer capillary mains inside of the cannula without the sudden overpressure causes destruction of tissue. In such a case of a special narrow outflow channel (as aspired in favour to a pain poor injection) the delivery of the drug (in retarded cycles) may be introduced before the measurement of the parameters of metabolism is finished. A certain base rate may be applicated as earlier as the further delivery may be interrupted, possibly, according to a calculated correction.

The Figure 99 shows crude schematically the connection of a modulating or throttle valve(565) with a control unit, which is developed also as an inductive fluid-flow measuring device and which effects the control of the throttle according to the flow rate which is answered back by the mea-

suring electrodes. Suches measuring devices are described by the literature for Patents multifariously. Par example by G.Geisler,A.Seebode in DE 33 14 954, K.Walter, F.Hofmann, W.Stelz, Ronald, Venloin DE 24 10 407 or by E.Prinz, G.Leiser in DE 27 44 845.

Figure 100 shows in a longitudinal section an alternating from one dosing installation into another using thereby only one motor.The power transducing bush(605) effects the transport of the ratched wheel(607) only clockwise by its pawl (606). The ratched wheel is firmly connected to the gear shift collar(809) turning free. By the gear shift pinion the gear wheel(859) is driven, which is fastened on the screwed rod of a multidosing syringe (e.g.), because it is coged to it. The turning of the ratched wheel(608) is transmitted to the drum(71) with the coulisse slot-tet link(72) in which the fixing pin(73) effects the lifting and the lowery by rotation. This shifting on axis works to the gear shift pinion and causes its position to the gear wheels. To change the respective dosing program the motor needs, additionally, only an half rotation counter clockwise effected by pole-changing. In such a manner a considerable space saving and weight saving is involved.

In the Figure 101 is shown a device for dosage change in using of solenoids or piezo-transducers as motor-drive at the top in a lateral view and below in an plan view. Between the short end of the swivel lever and the pressure transducer(564) exists an elastic connection(612). The swivel affixed cap(613) stand over the spring biased rod(614), whilst the spring lifts the rod when-

ever the pump stroke is activated against the expansion of the hose inside of the dosing chamber. But when a rapid traction impulse works by the pressure transducer, the cap leafs the rod and a spring which is made tense by a pressure lever (616) transmits the cap over the rod of the other dosing mechanism by swivelling.

Figure 102 shows in a longitudinal section a variation of the mechanism to move the cannula magazine vertically before and after the injection referring to the functional stages A and B. The cannula magazine(316), therefore, is easily to shift together with the central holding tube within a bush without seal. The end of the central holding tube broadens to a ring plate(536) which is sealed by an elastic membrane(537) towards the roof of the suction cup. The stage A shows, as the skin is raised into the suction cup by influence of suction and, at the same time, the ring plate (536) is put down so that the skin and the cannula meet. In stage B the skin and the cannula are withdrawn again one from other by the elasticity of the skin and the membrane, after the suction cup has been reventilated.

Figure 103 shows in the longitudinal section a variation of an injector in which, instead of a suction cup, a shell(538) is present to insure the cannula. The shell is formed as an ellipse in the one centre of this the central holding tube(324) is arranged capable to be vertically shifted whilst in the other center a central peg(433) bears a ring plate(535) which has a boring for the passage to letting through the central holding tube. Its lower surface being provided with a film(539) adhesiv on both sides.
Above in the stage A the central peg is lifted (similar as at the example of Fig.13) with the ring plate and the skin, while the central hol-

ding tube with the cannula was sunk dowards. Below in the stage B,in the contrary, the central holding tube has lifted and the central peg has been sunk so that the skin and the cannula are separated. The apply of air pressure may be avoided in this manner. Between A and B in a plan view the adhesive film(539) can be seen with the boring for the passage of the cannula which film is encompassed, appropriately, in a concarde-like manner by the adhesive electrode ring, and embedded between the two protective foils(540).

The Figure 104 shows in a longitudinal section the skin which is elevated ito a suction cup whereby polarized light is projected through the knob of the skin onto the detector which is arranged opposite. The measurement data which are determined in this manner can be quoted to the correction of the dosage. It is yet necessary to confirm, wether the sugar values which are varried more slowly in the tissue are qualified for the jugment of the actuell situation of metabolism.

The Figure 105 shows at the left side in a lateral view and on the right in a plan view the basic experiment which was charged to chec the modification of the electrical conductivity onto boundary membranes. A filter paper was stretched to the electrolytically defined silver-chloride-silver plate (610), laterally sealed, and sepharose - concanavallin A was infilled into interstite.
The other side of membrane was rinsed with a solution of common salt of different glucose concentration and measured against a calomel electrode(611). It was applied 600 V alterning current and significant measuring differences was affirmed.

Further data:

Amount of conA-sepharose-gel sediment	2,1ml
with about	21mg ConA.
Membrane surface	$5,3cm^2$
Passage through of glucose	about 21mg
Measuring effect by	about 1mg
Resistance of the arrangement (ConA-gel/NaCl-glucose/calomel-electrode	10 Ohm
Alteration of resistance after 100 mg% glucose solution	250 Ohm
Nominal frequency	10 kHz.

Trisaccharide raffinose as comparison solution was without effect.

With Figure 106 begins an elaboration for opto-photometrical and biometric measurements. The minimum blessure of a patient is given respective to metabolic measurements by the use of diaphany. To explore the conditions during the way of the light ray a kind of light ledge(900) with single ends of light transducing fibres(593) is vertically housed to a suction cup(173). Opposite to this light ledge a detector ledge(901) is embedded to the wall of the suction cup; to each light point or source(560) relates a belonging detector(561) with a light transducing fibre to the measuring instrument(88) and from there is an electrical conection to the control unit.
To the left the skin is raising and any of the lower dectors announce light absorption.
To the right the skin knob which is produced by negative pressure has its highest level and many detectors are shaded. When the control unit checks that an alteration is never more effected, the light absorption curve may be evaluateddd(as shown in the middle. At the time ordinate a spatium Delta, to mark as a wave, relates to the thickness of the skin. The light absorption has measured tangentially to the skin surface a maximum. A measuring ray may be used for a polarime -

tric obtaining of data relating to the state of metabolism, especially the contents of blood glucose. Therefore the computer of the control unit brings the results of the polarimetric measurement in relation to the thickness of the skin; the measuring ray has to cross the skin twice. The first measuring is completed while the skin is blood-less by the suction effect. About two seconds later the skiin is red by hyperemie; the polarimetric measurement is repeated at the same place and tne contents of blood glucose is estimated by constituting of the difference value. At the light absorption characteristic a second increase relates to the hyperemie.

Figure 107 shows also in a longitudinal section a measurement arrangement similar to them of Fig106. Only two light sources(560) and two corresponding detectors(561) touched by the raising skin are demonstrated. The light absorption curve, gained by subsequent measurements, shows a similar course as demonstrated at the Fig.106. P_1 this is the point of the identification of the skin thickness, P_2 relates to to the beginn of the hyperemic phase.

At the cross-sectional view of the Figure 108 the posssibility is schematically shown to check a blood vessel(902) laying immediately under the skin. Two measuring rays cross near the cannula shaft(8). The psosition of both light sources and detectors is respectively low with intent to investigate the conditions when the skin is´nt yet raised. THe reventilation should be effected by the valve opening over the function of the control unit before the cannula tip has pierced the skin.

Figure 109 is a schematical cross section to demonstrate a similar solution to said of Fig.108. An addititonal measuring ray is introduced for

a comparison of the light absorption near to the cannula. As a second way of solution the reflex photometry is indicated, especially as a means to check the nearness of a biger blood vessel or the contents of blood vessels and their extent of ful fullness, measured by the comparison between blood emptiness and fullness (e.g. a single light source(560) and detector(561) is represented). Calor filters or different wave length of light may be used. An alterning measurement may be applied by a ray source which serves as a detector also(903). A similar mode of operation may take place using a temperature-sensor(904) nearly to the skin knob.

Figure 110 shows in a partial schematical cross section at the scale of 2 : 1 the use of an measuring arrangement tangentially working against and through the skin of the knob. Preferably such device may be housed within the wall of suction cup inside of the inner sealing zone(505)(Fig.112) whereon the skin knob has a defined circumference. Belong to the bended light ledge(900) and detector ledge(901), again, a strong correspondence exists. The single measuring rays should be equally spaced. The spatium between the single light source or lamp and detector pairs increase in a fixed and known manner(e.g. from $1\text{-}d_1$ to $1\text{-}d_6$. The light absorption respectively increases but it diminishes at $1\text{-}d_6$ because a larger part of the spatium lays into the interstite with lower light absorption. The space between $1\text{-}d_1$ and $1\text{-}d_5$ marks the thikeness of the skin. This measuring arrangement may be used also to estimate the amount of blood vessels or blood which may be passed by a (e.g. polarized) measuring ray running diagonally through the skin knob(560,561).

As far as each single ray is calculated to run through skin tissue it is participant to the total measuring result which is gained as an average value. AS shown a biger blood vessel(902 positioned laterally from the passage through of the measuring ray for the glucose destination may falsifay considerably so that a correction is inevitable. Therefore at least one second transversally working ray screen(I,II,III...) is usefull positioned with a angle shifting to the proper tangentially measuring arrangement(1,2...) which works at a angle of 90 degrees to the ray for biochemical investigation. If a ray of said proper tangential arrangement is lessened, the control unit activates the ray of the auxiliary measuring arrangement classed with those ray (That means the ray cutting the former together with said diagonal ray for the biochemical investigation, all that three effected as subsequent procedures). The auxiliary tangential ray runs a spatium inside of the skin which depends from the distance of the last inner proper tangential ray and can be calculated. In the case that both the proper and the auxiliar ray are lessened the absorption peak should be brought about by a body(generally a vessel) positioned within the passage through of said diagonal ray and should consider the total measuring result. Of course, at least one further diagonally ray nearly to the investigating ray could be used for a clearing-up of our problem. Generally, a combination of all the here decribed principles may be used.

The Figure 111 is a principle set up of the function even described and combined with the features of the Fig.107. Each electronic expert is therefrom enabled to carry out a more professional

wiring or block diagram. As in all control parts of this invention as well processors as TTL-logic or CMOS technic or similar may be used.
In the first step(1) the ray_1 may be reached by the skin knob and a signal may be obtained as long as the light absorption increases. In this case in the moment while the knob reaches the ray_2 than the reventilation valve should be activated by the control unit. The distance (by a light and detector ledge adjustable for each skin type) betwenn ray_1 and ray_2 is adjusted in such a manner that, normaly, the ray_1 has left the tangential position to the skin when the knob reaches the ray_2.
In this case, at step(2) the skin contact s the inner sealing zone and thereby the transversal ray arrangements. The proper arrangement(1,2,3,4,...) deliver its measuring data(3). The control unit figures out the programmed extents and compares them(4). The decrease of absorption caused thereby that the ray_6 leaves the upper solid skin parts in its middle passage, brings the result of the thickness of the skin(5) (as the spatium 6-1=5). If the comparison of the extents relative to the skin passage yields similar values, the beam or ray(560,561) used for investigation is started(6) and its measuring result is composed with the result of prior measurements (7). In such a manner the blood sugar value can be transmitted to display, printer, and dosing device(if any) (8).
If the measuring comparison at step(7) shows irregularities in regard to programmed limits the stage (9) is chosen to activated at least one ray of the auxiliary arrangement or bundle correspondig to the incertain point or peak.
If the comparison of ray and reference rays shows not inequalities exceding the programmed limits the process lead back to the activation of the

resulting organs(8). In the case of a lower light absorption along to the tissue for the auxiliary ray the value of the proper ray should be suppressed(9) and possibly -if the quantity of useful single measuring results is insufficient(10) according to the comparison- replaced by measuring values of the bundle of the auxiliary ray arrangement(11). The incertain result evokes(12) the warning mechanism(87), the satisfactory result leads back to the activation of the resulting organs(8).

Figure 112 is a longitudinal section of a mechanical driven suction injector at a scale of 2 : 1. The lower part of housing is omitted to safe place for reference numbers. The injector consists at its upper part of a container cylinder(19) with an ring-shaped chamber(905) from which a gas pressure control valve(906) leads into the inner space, whilst a nonreturn valve(907) is connected to the interior of the gas producing chamber(908) by the connection hose(909) this hose being turned in windings above to the case of said gas producing chamber. Said case has below a bush(910) with a snap-in spring(911)centrally inserted for the locking of the end cone (912). The tape-measure(913) lies in folds to the left and is pushed through a slot of the lens carrier(921) behind a lens-like window(85). Mentioned may be the sealing ring(914) between cover (138)and the shoulder of the container cylinder (19), the annular groove(915) for the fixation of the three sliding bolts(916) for the bolting of the connection bridge(916) with the pierced plate or disk(112). Mentioned may be also the screwed clamp ring(920) for the cover(138), the central bore(118) for the passage of the dosing rod(110), and the screwing nut(919) for the fastening of the container cylinder (with the drug containing fol-

ded bellows(20)- at the housing cylinder(1) of the lower part of the suction injector. A kind of rotary muffle(922) turns about the housing cylinder(1) fixed on the height; it bears a profile ridge or ledge at its upper an lower side -saw thooth like alternating- wherein the upper and lower rotary pins(923) engages to transform the revolution of said muffle in a pendulum motion of the connection bridge(917) which is guided longitudinally in a slot of the housing cylinder. Three connection bridges equally spaced safeguard a equal power transmission towards the rod(110) of the dosing pump. The pump housing(111) containes casted about the spindle (924) dosing inside of the drug hose(44) oval ring-shaped chamber with pressurized gaz with at least one channel toward the hose in the region of the dosing chamber. On the left the spindel is in the upper position and seals the dosing chamber against afflux; on the contrary on the left half the spindle is lowered sealing the flow through the cannula whereby the dosing chamber is filled up with drug. The pump housing is fastened to the housing cylinder by a spring resilient bolt(925). The motor for the dosing(and the other main functions) is the spiral spring (31) mounted between said rotable muffle and the toothed wheel(926) and fixed on the housing cylinder(1); with its one the spiral spring is fastened here. The other free end of said spiral spring communicates by the angle bar(927) with the wheel(928) (on the left). On the right the lever(929) is shown excentrically pivoting about the axis(929) which is fastened by the strap(930) on the housing cylinder. The lever may be swivelled by the plug(931) on the wheel(928) which takes along said lever overcoming him at the first step of the clockwise revolution. The lever ends

in a very elastic leaf spring and this clearance is restricted by boundary pegs(932) projecting from said strap to promot the overtaking mechanism. The vertically peg(933) projecting from the lever(929), transmits the motion to the bush(934) with rim ledge engaging in horizontal slot therein. This bush lowered by the guidance pin (935) fixedly fastened onto the housing cylinder; this bush making away in its oblique wall slots (936). Three skin distanting rods(937) insert to the bush(938) and suspend with their heads(939) and a cross-pin in oblong slots of said rim ledge operated by the movement of the bush(934).
To explain the mechanism for reventilation and skin distancing the longitudinal section plane was turned in the right hand side as shown in Figure 113 as line A - B. Continuing on the left, the angle bar(927) communicates its motion via the wheel(928) to the rotary disk(941) after a clearance within an oblong slide(940); the angle rod(942) transmits this motion from said rotary disk(941) to the rotary muffle(922) which operates the dosing pump. Said rotary disk rotates arround the a prolongating bush of the transport disk(943) for the spring resilient blocking bar(944) serving as the dosing obstacle for said angle rod(942). Beneath said transport disk(443) the sector disk(445) is mounted connected with said transport disk for the blocking bar with a clearance resilient by the spring(946). From said sector disk three pins(947) project (equaly spaced arround the circumference) through short horizontal slots of the housing cylinder(1) and through oblique slots onto the sliding cylinder (948) lowering them together with its dropping pins(949) which causes the pushing downwards of the vacuum reservoir cuplet(5) through a sealing membrane(950). To operate this drop-

ping mechanism a second over-taking mechanism is provided. It consists by a sliding pin(951) with a large collar for the abuttement of two compression springs at both sides of said collar; said pin(951) beeing slidable by means of a little cross-pin moved into an oblique guiding slot(952, Fig.113) of said sector disk(945). At the function stage as shown, said sliding pin(951) is moved to the left side and engages in horizontal slot(953) of the inner face of the adjusting ring (954) has limited horizontal groove which permits a clearance of revolutions for said adjusting ring although the motion of the rotary disk(941) is locked by the impact of the angle rod(942) to the blocking bar(944). Regarding to the starting mechanism for dosing this consists of a swivel segment disk(955) with an inner worm shaped link (as a vertical projection shown in II of Fig.114) which is rotable arround its excentrical axis (956). Said segment disk(955) is raised thereby a little by a gradient of its axis screw as to engage with is elastic resilient detent or pawl (957) to the ratched wheel of the lower face of said rotary disk to prevent a premature running back by the effect of the spiral spring(31). The above mentioned link(958) is engaged by the cross pin of the quadrangular bar(959) which is slidable onto a passage through the fixed strap (960) its lower and being sealed fastened to folded bellows(961). Therefrom a channel(962) leads to an opening between the elastic outer collar(147) rim and the inner sealing zone(963) of the suction cup. The downward projecting cam (868) of the adjusting ring works against an elastic tongue of the segment disk(955) as a third over-taking mechanism.

Inside of the accomodation cylinder(144) a vacuum reservoir cuplet(5) is inserted in sealing con-

nection with the cannula attachment piece(47) of the injector. On the left half the stage prior to use is demonstrated, on the right the stage during the injection. The annular piston(9) arround the cannula shaft continues centrally in a bush (964) with a cover plate; this faces with a toothed cutting edge ring to the cover membrane(6) made of aluminium which extents between the cuplet rim and said bush. The elastic boundary or boder membrane(1o) extends from the cuplet cylinder to the inner part of the annular ring. Behind the latter negative air pressure is preserved in the vacuum storage space(11). To the left the cuplet is shown prior use, to the right half during use. Similar, the dosing pump to the left has its rod raised for stopping of the afflux from the folded bellows. By the pressured gas bolster(925) the hose is pressed inwards against the cavity of the dosing spindle. In such a manner the drug from the dosing chamer flows out through the cannula. To the right said rod with the dosing spindle is lowered piercing the membrane inside of the cannula funnel with its sharpened point. The spindle perevents the drug to flow against the cannula but permits the afflux to the dosing chamber which is blowed up by the over-pressure from the folded bellows.

To prepare such a suction injector for use, a folded bellows with the gas producing chamber (908) and the pump housing(111) as a plug-in unit in the whole is pushed into the container cylinder(19). A cap of the connection hose(909), is removed after the hose was squeezed and the conical end is stuck into the funnel of the non-return valve(907). The tape-measure(913) is introduced onto the slot of the lens carrier(921), than the latter is deposed with its holding arm into the niches of the container cylinder wall.

The hose squeezing is unblocked and the cover (138) tightly fastened by its screwed clamp ring (920). The folded bellows may be adhesive sealed with its under face toward the bottom plate of the container cylinder. The gas producing chemicals may be brought together by shaking, after the pump cylinder(1) and the container cylinder is subsequent screwed on. Prior, the sliding bolts must be closed arround the pierced plate or disk(112).

The Figure 113 shows a simplified cross section along to the line A - B of the Fig.112 showing the spring resilient blocking bar(944) which may be pulled and rotated clockwise keeping with a dosage scale at the surface case(965). The edge-shaped end of said quadrangular bar engages with the fixedly toothed wheel(926) one tooth space corresponding to one dosage step. Beneath the transport disk(943) in its oblong slot the resilient spring(946) for the backwards movement of the sector disk is shown. The latter is moved by a cam(968) on the adjusting ring(954). The effect of the oblique guiding slot(952) of the segment disk against the cam or cross-pin of the pin(951) is demonstrated with dashed lines, this slot lies lower. With dashed lines also the oblong slot of the rotary disk is shown -the corresponding slot ofthe transport disk is traced with full line.

The Figure 113 is a cross section along to the line C - D of Figure 112. It shows the position of the suction switch with its folded bellows (561) and especially the recesses(966) for the pluging-in of light ledges whose are joint together and with the control unit with measuring (88) and warning(87) function by an elastic belt (967).

To use a suction injector as described in Fig.112 to Fig.114 the blocking bar(944) may be pulled

and rotated by its transport disk along the dosage scale for preparing a single dosage. Than the adjusting ring may be rotated clockwise against the pre-tightened spiral spring(33). During the clearance by the oblong slot(940) the lever(929) is swivelled while the distanting rods(938) being raised. At the same time the cam(968) moves the segment disk(955) which is screwed upwards as to engage with its pawl(957) with the ratched wheel of the rotary disk(941). From this instant, a backward movement of the wheel(128) not takes place again as to facilitate the manual operation. A further revolution of the adjusting ring transmits its motion to the rotary disk(941) by means of the angle bar 937) at the end of the oblong slot(940). When said angle bar pushes against the blocking bar(944 there is a hole within the outer face of the fixedly bush of the toothed wheel(926) whereinto the pin(951) evades by the effect of the pre-tightened spring at its left side. The end of said pin(951) is withdrawn from the slot(953) at the same time as to freeze the motion of the adjusting ring which effects against the weak spring(946). The rotation of the sector disk(945) causes the lowering of the pins(949) against the upper rim of a used vacuum reservoir cuplet(5), which can be grasped, removed, and replaced by a new cuplet.

Subsequent to having pressed the bush(964) against the skin, the aluminium or cover membrane (6) breaks near at said bush, air enters and drives the border membran which may be thereby stretched into the suction cup. By pulling of said border membran and pushing by manual pressure the cutting edge of the plate of said bush cuts the cover membrane in a ring-shaped manner along the rim of the cuplet. An adhe-

sive sealing plate(969) may support the descendent skin while the tip of the cannula pierces first said sealing plate and then the skin. The negative pressure sucks the air from the suction switch as to pull the bar(959) with the diminution of the folded bellows(961). Under the effect of a separate spring the motion of the segment disk(955) for short distance because the profile of the link(958,II Fig.114) resists to the cross-pin of said bar. After the skin is sealed arround the inner(and seal) zone(963) of the suction cup, the outer space towards the outer elastic suction cup rim or collar(143) is reventilated and thereby the folded bellows of the suction switch. Te latter extends by its own elasticity and tne bar(559) lets the motion of the segment disk free thereby. At this further motion the segment disk descends into its axis thread and the pawl retracts from the ratched wheel of the wheel(928) which is driby the spiral spring(33). The counter clockwise revolution of the angle bar(927) effects a motion of the rotary muffle(922) which is tranfered over the connection bridges(917) to the pierced plate or disk(112) and thereby to the pump rod(110). After the preprogrammed pump cycles are are finished and the dosis is thereby injected under the skin, the motion of the rotary disk is blocked by a peg projecting from the surface case at the zero point of the scale(not shown). The slot(953) permits the wheel(928) to rotate a further distance. Therby the lever(929) is taken back and the distanting rods(937) are lowered against the skin. The latter is withdrawn from the inner zone of the suction cup -reventilated by this manner- and the skin is distanced from the cannula tip to avoid cutting wounds.

The contents of the drug container can be alway proofed by means of the tape-measure pulled past to the lens-like window(85). When the supply is exhausted during the injection, the end cone (112) is arrested by the spring(911). Now, the stroke of the dosing rod(110) is blocked and therewith the other provided automatical functions. The patient is compelled to pull off the injector from the skin and to repeat the injection with the new programmed resting dosis.

Figure 115 shows in a schematical longitudinal section at a scale of 1 : 5 a suction injector consisting of two parts connected by a spring 969). The lower part, mainly, consisting of the suction, in this example joint by a channel with a surrounding boiler(972) with resistance heating wires(178). During the electrically performed heating the hot and thinned air escapes by the valve flaps(184) and enters again through those when the three tripping tabs are activated(similar as described in Fig.82). The drug hose towards the cannula is rolled up and can be prolonged when the upper handle piece is lowered against the suction cup. The plugs(970) enters thereby into the niches(974) of the handle piece of the suction cup piece safeguarding a rigide and inflexible connection between both parts. After the vacuum effect is started the manual pressure against the skin shoud be released and this, finally, may also event by fatigue, as an essential condition of an unhindered gliding of the skin into the suction cup. The pressure(spring(971) promotes this keeping of distance which allows even manual angle movements without danger to break off the vacuum within the suction cup.

Figure 116 shows in a longitudinal section a corresponding solution of this problem for a device as described in Fig.112 to 114. A over beaker supported by the spring(971) swings about a suction injector typed as in Fig.112 serving as a buffer for movements away from the injector axis. During starting the vacuum effect a firmly connection between both parts is ensured by the engangement of the cover plug(970) into the central niche(974) of the injector cover. Arround the injector housing a collar(973) supporting said spring(969) is slidable mounted to facilitate the removal of the upper part of injector for the access to the lower part.

Figure 117 shows a special cannula having a hoslet inside, which is bent back with its free end while the other end is tightly connected with the attachment piece(47). When fluid is filled into said hoslet, its free end is driven out of the shaft(379). If that is done after the cannula tip has pierced the skin, the fluid can be injected in lower parties of the subcutaneous tissue. An other advantage is given with the possibility to lengthen the spatium with skin contact if a sensor coating of this hoslet is provided. The device is shown in a longitudinal section at a scale of 5 : 1.

Figure 118 shows a simmilar cannula as this of Fig.117. The only difference is that the hoslet clapped inside with its free end which can be unfolded by pressure from the fluid.
To the left the stage is demonstrated with the cannula prior to use, to the right the stage during the use.

Figure 119 shows a cannula similar to said of Fig.107 and 108. But the hoslet is made of high

elastic rubber-like material with thinning towards the end, initially yet closed by a thin membrane of the wall(to the left). When fluid is applied with pressure the hoslet is extended leaving the shaft with its end which bursts.

Figure 120 is further improvement of a type of dosage hydraulic as shown in Fig.95. A longitudinal section is given. The device consists of a cylinder(272) of a step syringe as supply container including a separation piston(275) with a central bore. This bore is closed by a little valve piston(168) which is driven by means of a rod connected to a solenoid(413). The latter is incorporated in a supporting piston(802) fixedly fastened to said separating piston. Said valve rod ends with a conical calibre jump abutting against cross-pins(752). If the wires (975) leads current, a pumpe stroke is caused by the solenoid.
By lowering of the valve rod its conical portion urges the cross-pins against the cylinder wall. By that the motion of the both large pistons is locked. In further phase of lowering of the rod its cross-beam(976) strikes the guiding tube(977) and, finally, effects a determined stroke of the little valve piston. Such is caused a direct displacement of the drug towards the cannula. To prevent a back-flow during the return-motion of the little valve piston a nonreturn valve is necessary. Such may be substituted by a cannula with prolonged hoslet as decribed in Fig.117-119, the collaps of this preventing such back-flow.

Figure 121 shows in a longitudinal section a device similar to said of Fig.120. The separation piston is sourrounded at its lower end by a hose ring(415) which may be filled with auxiliary

fluid from a dosing pump(168) It is driven by the solenoid(413) in pump-cycles. After the first pump phase the blowed up hose ring lockes the motion of the separation piston(275). A further determined swelling up of said hose ring effects the displacement of the drug from the cylinder (272) of the step syringe.

Figure 122 shows in a longitudinal section a part of a suction injector with a vacuum reservoir cuplet(5) inside of the accomodating or housing cylinder(1). Between the annular piston(7) and and the cuplet cylinder extends the roll membrane(976). Before the annular piston lies the border membrane(10) which can be stretched. The annular piston is held (against the suction from the cuplet chamber) by the abutting disk(977) with its three outer projections(978). These projections abut on the inner projections(979) of the border ring welded to the cuplet cylinder. Below, in a schematical cross section, the three projection pairs are shown inside the housing cylinder(1). To the left(I) the obliquity of the abutting surfaces of the projections are shown necessary for a rotation caused by the triggering lever(980). This may be mounted inside of a collar membrane(981) which contiues the collar of the suction rim. A rotation of said levers, equally spaced about the housing cylinder, causes with its angle(982) the revolution of the abutting disk(977) arround the central bush(964). Thereby, the projections disengage and the annular piston(7) is lifted together with the skin.

While the invention has been illustrated and described as embodied in an injecting device, it is not intended to be limit to the details shown since various modifications and structural, changes may be made without departing in any way from the spirit of the present invention.

Examples for an automatically dosis adjustment

in the case of tissue glucose level differing from the exspectated value:

retard insulin	nominal values glucose tolerance +not having eaten nominal value	actual values glucose patient 1 patient 2	correc- tion factor unmod.Ins.	dosis correction calculation inclusive patient 1 retard ins.	patient 2	applied unmodified insulin patient 1	doses retard insulin patient 2
80E	90-120 mg/p.c.	180mg/p.c.	10	10x1x8		+80E	
	100mg/p.c.	50 mg/p.c.	4		4x1x20		-20E=60E
60E	90-120 mg/p.c.	180 mg/p.c.	7	7x1x8		+56E	
	100 mg/p.c.	50 mg/p.c.	12		12x1x5		-60E=0
40E	90-120 mg/p.c.	180 mg/p.c.	5	5x1x8		+40E	
	100 mg/p.c.	50 mg/p.c.	4		4x1x5		-20E=20E
20E	90-120 mg/p.c.	180 mg/p.c.	3	3x1x8		+24E	
	100 mg/p.c.	50 mg/p.c.	12		2x1x5		-[illegible]
16E	90-120 mg/p.c.	180 mg/p.c.	1	1x2x4		+8E	
	100 mg/p.c.	50 mg/p.c.	2		2x1x5		-10E= 6E

TABLE 1

C l a i m s :

What I claim is:

1. A device for the injection of fluids under the skin,
therby characterized,
that at least at the nearness of the cannula a sensor is arranged, which allows to measure alterations of metabolism in the body and to prepare the measurements for the information.

2. A device as claimed in Claim 1 ,
thereby characterized,
that the cannula itself is developed as sensor to prepare alterations of the metabolizme in the body for the information.

3. A device according to claim 1 and 2, wherein the cannula shaft, behind the ground surface and sustaining ring closure thereof, is opened duct-like, the lacking wall being replaced by an inlay of synthetic material and endowed with sensor properties.

4. A device according to claim 1, 2 and 3, wherein special insulating zones with respect to conductivity are provided between cannula shaft and the duct-like opened shaft.

5. A device according to claim 1 and 2, wherein a smal hose having sensor properties is attached on at least one portion of its surface, and this in tight connection with the drug feeding channel within the duct-like opened shaft.

6. A device according to claim 1 and 2, wherein at least one thin tublet is mounted in the bore of a cannula and endowed with sensor properties.

7. A device according to claim 1 and 2, wherein within the cannula shaft there is provided a cavity at at least the top portion into which the sensor coating is placed.

8. A device according to claim 1 and 2, wherein on the link to the cannula there is provided both an inner contact with the conductor within the cone of the overplugged cannula and an outer contact, which latter contact reaching spring tongue-like over the cannula adapter as sliding contact.

9. A device according to claim 1 2, wherein a cannula is provided on that end, which is opposite of the cannula shaft, with an opening for accomodating the shaft of another iden-

tical cannula, the feed of the drug or preparation taking place from the side.

10. A device according to claim 1 or 2 and 9, wherein the cannulas are stacked one above another in a tube-shaped container, with accomodating one cannula shaft of an adjacent identical cannula in the shaft bearing body and supplying the drug laterally.

11. A device according to claim 1 or 2 and 9, wherein the cannula comprises a cannula body subdivided into an upper and lower chamber, the upper chamber of which functioning as chamber for accomodating the shaft of an identical cannula.

12. A device according to claim 1 or 2 and 9, wherein the cannula body is laterally provided with an annular groove.

13. A device according to claim 1 or 2 and 9, wherein the upper cannula chamber is closed by a septum having a central hole.

14. A device according to claim 1 or 2 and 9, wherein the cannula between upper and lower chamber comprises an annular notching functioning as hinge joint.

15. A device according to claim 1 or 2 and 9, wherein the cannula are stored within a hose.

16. A device according to claim 1 or 2 and 15, wherein an operational cycle sets in above a cannula exchange mechanism in the suction cup cover, in which cycle used cannula will take up, in the container hose, the space of unused cannulas.

17. A device according to claim 1 or 2 and 16, wherein at least one seal is slidable mounted within the reservoir or container tube so as to separate used cannulas for unused one.

18. A device according to claim 1 or 2 and 17, wherein an elastically compressable body endowed with springiness is located between two sealing bodies in the reservoir or container hose, which body operates so as to store a momentum of movement for the cannulas.

19. A device according to claim 1 or 2 and 17, wherein a sealing body has been provided in the cannula magazine behind the last unused cannula, the body of the cannula being itselg suited to function as sealing body and the end of the cannula magazine having pressure gas introduced thereinto so as to push the cannula forward.

20. A device according to claim 1 or 2 and 9, wherein a thread-like interconnection exists between the cannula bodies, which interconnection permits said cannula to be transported by way of pulling or draft action.

21. A device according to claim 1 or 2 and 9, wherein an air-tight releasable connection exists between each one upper and lower chambers of different cannulas.

22. A device according to claim 1 or 2 and 9, wherein cannulas and cannula magazine deviate in cross section from the circular shape.

23. A device according to claim 1 or 2 and 22, wherein the drug or preparation inlet opening intothe cannula is located on a flattended portion of the cannula body.

24. A device according to claim 1 or 2 and 9, wherein the cannula body comprises in its wall a conduit being adjustable in height and extending parallel to the cannula shaft in order to save or economize on a lower chamber for introducing the cannula shaft of the adjacent cannula in the cannula body.

25. A device according to claim 1 or 2 and 15, wherein both ends of the hose for cannula storage are united by means of banderole.

26. A device according to claim 1 or 2 and 25, wherein the cannulas, before connecting the hose storing them to the injection device, are prevented by at least one pin or thread transverse to the direction of conveyance of the cannula from filling out the hose.

27. A device according to claim 1 or 2 and 9, wherein a leaf spring is provided at the end of the central retaining tube for the cannulas, which spring dislocates the cannula passage while unblocking it via a bore when a switching or tripping mechanism acts thereupon.

28. A device according to claim 1 or 2 and 27, wherein the leaf spring at the end of the central retaining tube is actuated by a trip pin in connection with the supporing arm or bracket for magazine hose.

29. A device according to claim 1 or 2 and 9, wherein an accomodating tube is provided for taking up said used cannulas, a resilient sleeve being slidable on said tube and comprising spring bending for the cannula transport in one direction.

30. A device accerding to claim 1 or 2, wherein a loop(192) is attached on a connecting cone(224) extending in the cannula shaft, which loop permits the cannula to be removed from the suction cup subsequent to it having been utilized therein.

31. A device according to claim 1 and 2, wherein a bracket is provided for a conductive overpluggable bracket for attachment of a cannula towards the shaft of the cannula, across which bracket a junction of path to a measuring device is provided.

32. A device according to claim 1, 2 and 31, wherein the measuring device is supported on an elastic arm band whereby a contacting pad having electrically conductive properties with respect to the skin is retained.

33. A device according to claim 1 and 2, whereby the cannula is connected to a drug feeding hose of an infusions pump associated with a measuring device.

34. A device according to claim 1, 2 and 33, wherein the cable to the measuring device extends, by sections, within the outputting tube functioning also as insulation.

35. A device according to claim 1 or 2, wherein an elelctronic storage unit is provided whereby measured data are stored at regular intervals to be later displayed via a reader outside of the device.

36. A device according to claim 1 or 2, wherein a plate having skin-adhesive properties is provided within the injection device, which plate provides spacing for permitting a cannula to pass when said plate is moved upward by a mechanism and the skin to be raised.

37. A device according to claim 1 or 2 and 36, wherein said plate is disposed within an envelope safeguarding that the surrounding skin is kept at adistance.

38. A device according to claim 1 or 2 and 37, wherein a mechanism is provided to move the mounting support of the cannula towards the skin.

39. A device according to claim 1 or 2 and 36, wherein two double-sided adhesive sheetings or foils in cocard- or rosette-type arrangement are provided between two protective sheetings, the interior of which being destined to be attached to the plate and the ring-type exterior to be attached to the rim of the envelope or shell.

40. A device according to claim 1 or 2, wherein said device is utilized in connection with a suction injector device operated to have the skin raised by negative pressure within the suction cup into the cannula.

41. A device according to claim 1 and 2, wherein the cannula is arranged inside a reservoir cup let preserving said negative pressure and has a lead issuing from its shaft capable of being connected via a jack or connector on the reservoir cuplet to a cable leading to the measuring device.

42. A device according to claim 1 or 2 and 41, wherein a valve pin inside of a tubular guide or conductor is slidably mounted in a negative pressure preserving reservoir cuplet with suction cup, the upper tube being closed by rectifying co-covering sheeting or foil, whereas the valve pin surmounts the suction cup rim prior to use and comprises a type of leaf spring abutting the suction cup rim and being approprietely constructed so as to move the pin upward more abruptly.

43. A device according to claim 1 or 2 and 41, wherein the rim opposite of a cover membran(6) and partof a vacuum preserving cylinder(5) is enlarged to form a border ring(223).

44. A device according to claim 1 or 2, wherein a surface support is provided in the vicinity of the suction cup as prophylactic measure to prevent the device from tipping during the injection operation.

45. A device according to claim 1 or 2 and 40, wherein the mounting support for the cannula supports an annular plate at its end inside of the suction cup, which annular plate is connected to a membrane sealed against the suction cup roof or dome in order to descend upon the action of suction or negative pressure inside of the suction cup together with the cannula and to return by spring action subsequent to reventing the suction cup again into the more elevated initial position.

46. A device according to claim 1 or 2 and 40, wherein the suction cup is slidable mounted, against the action of springs inside of a traversing slide or guide bush in manner so as to

be retained by a snap-in device for a period of time until the reventilation of the suction cup has been effected.

47. A device according to claim 1 or 2 and 40, wherein a control pin, subsequent to injection and prior to the termination of re ventilation of the suction cup, is moved inside of said suction cup towards the skin so as to keep ist at a distance form the zone of the cannula tip.

48. A device according to claim 1 or 2 and 40, wherein a valve, during the action of rendering the suction cup space or chamber smaler by way of approach and during penetration of the skin, prevents air compression in said suction cup.

49. A device according to claim 1 or 2 and 40, wherein at least a sand or dust filter is provided inbetween the suction cup chamber or space and that space or chamber in which the suction cup piston is didsplaced in a cylinder for generating negative pressure or vacuum.

50. A device according to claim 1 or 2 and 40, wherein the spring for the suction cup is placed under tension intermediary of a Bowden wire in actuating the supporting arm or bracket for the suction cup cover.

51. A device according to claim 1 or 2 and 50, wherein the lever arm connected to the hinge of the supporting arm for the actuation of said Bowden wires to effect movement of the piston have an angular position such that an excessive stroke is caused so that the action of the spring retains the supporting arm in a terminal position.

52. A device according to claim 1 or 2 and 50, wherein a telescopic rail is mounted at the supporting arm for the tube with cannulas in order to facilitate actuation thereof.

53. A device according to claim 1 or 2 and 40, wherein said piston inside of a suction pump, the suction piston of which is moved by spring, is additionally prevented in effecting initial movement during its snap-in position by way of friction augmenting means.

54. A device according to claim 1 or 2 and 53, wherein said piston inside of a suction pump, the suction piston of which is by a spring, is additionally prevented in effecting initial movement during its snap-in position by way of magnetically active means.

55. A device according to claim 1 or 2 and 40, wherein the suction piston is retained, by means of a rod, in its position prior to the generation of negative pressure, sealed inside of a type of bellows with respect thereto and with respect to its bearing bore.

56. A device according to claim 1 or 2 and 40, wherein an opening for reventilation, communicating with an electromagnetic valve, is provided inside the space in which negative pressure is maintained during injection operation.

57. A device according to claim 1 or 2 and 56, wherein the electromagnetic valve is comprised of an elastic membrane having a disk made of magnetizable material in the center, which disk

is urged by an electromagnet depending on its direction of current flow in its winding towards a venting opening, in closing it or being attracted by the magnet to the opening.

58. A device according to claim 1 or 2 and 46, wherein a valve is provided between suction cup chamber and suction cylinder space, which valve is opened, when the suction piston returns in its position, prior to suction generation for reventilating said suction cup.

59. A device according to claim 1 and 2, wherein a control unit is provided which evaluates the signals detected by the sensor cannula, transmitting them to a printer and a display unit, and transmitting instructions to at least one dosing device.

60. A device according to claim 1 or 2, wherein drug injection is carried out automatically via a proprogrammable dosing device, and wherein the dosis to be dispensed may be set, via a computing and control unit, into relationship to the detected or determined measured quantities.

61. A device according to claim 1, 2 and 40, wherein a metal ring on the suction cup rim functions as comparison electrode for the measuring unit.

62. A device according to claim 1, 2 and 40, wherein a ring-type adhesive electrode is provided for the attachment of the suction cup rim.

63. A device according to claim 1 or 2 and 60, wherein the control or operative elements for

programming the dosage of the drug or preparation in association with temporal length are for functional clarity combined into blocks.

64. A device according to claim 1 or 2 and 59, wherein the contol or operative elements are provided on the inner rim thereof with regularly spaced notches or recesses causing reactions to contacts for programming.

65. A device according to claim 1 or 2 and 64, wherein control or operative rings are mounted in series and slidable about the housing cylinder, which rings arranged in row and having an inside surface of wave-like configuration, actuate two sequenced contacts on a switch panel, when rotation about respectively one snap-type switching position, following one another and in such manner that the matrix for the switching poisition is determined from the sequence of the actuation.

66. A device according to claim 1 or 2 and 65, wherein issuing from at least one control or contactor ring is, hook-like, a type of control or operative pin which may encounter a projection or a similar control or operative pin of another control or contactor ring, without allowing it to be moved therepast.

67. A device according to claim 1 or 2 and 65, wherein the numbers on the outer ring of the control or contactor rings are raised and may be placed in rows for programming such that the program data can be printed out via a reproducing system.

68. A device according to claim 1 or 2 and 65, wherein the control or contactor rings have ribs provided on their sides facing one another so as to facilitate locking of said rotation motion by an increase of friction.

69. A device according to claim 1 or 2 and 68, wherein a locking device to be actuated by means of a key retains said control or contactor rings in their program position.

70. A device according to claim 1 or 2 and 60, wherein at least one counter unit is provided wherefor the data store, relative to the amount of drug dispensed by the associated dosing device -which data being processed in such a manner that subsequent to a predetermined amount of the drug-, an alert or alarm is actuated and, when the supley is nearly exhausted, a printer is rendered operational.

71. A device according to claim 1 or 2 and 60, wherein a counter unit is provided which detects via at least one counting contact the consumption of cannulas of a magazine and which actuates via data processing subsequent to a previous determined number of cannulas an alert or alarm and, when the magazine is almost empty, a printer is rendered operational.

72. A device according to claim 1 or 2 and 59, wherein the contact in the central supporting tube for the cannulas, which contact functions to transmit data between the cannula shaft and the measuring unit and, functions also, simultaneously as contactor switch for the counter unit with respect to the consumption of said cannulas.

73. A device according to claim 1 or 2 and 59, wherein a contactor switch in the operative range of the contactor or control pin for the exchange of cannulas transmits the data of count relative to the consumption of cannulas to the counter unit.

74. A device according to claim 1 or 2 and 59, wherein the function of printer is delayed for a predetermined period of time to the receipt of data from the measuring unit with continued advance of the recording or logging band.

75. A device according to claim 1 or 2 and 65, wherein the control or contactor rings have for rotation, inside of the respective spring-guarded snap-in position for determining a stage of adjustment, some back-springing play in order to interrogate by means of actuating a switch the actual effective index value from the electronic store on an assiciated reader.

76. A device according to claim 1 or 2 and 59, wherein instruction is given by the indicating means for refilling the almost exhausted drug supply from a new supply reservoir, the drug outputting tubes being, in keeping with the provisions of construction, interconnected and pumping back, via the dosing device, the difference amount required for replenishing an expected programmed dosis into the nearly empty supply container or reservoir.

77. A device according to claim 1 or 2, wherein the drug supply container or reservoir is first unblocked electromagnetically for outputting from the device when the drug supply is emptied to a predetermined extent.

78. A device according to claim 1 or 2, wherein on instruction of the patient a multiple of an approximate daily dosis is determined via a control unit to be transfused via the dosing device into the nearly emptied supply reservoir, and pumped back.

79. A device according to claim 1 or 2 and 60, wherein at least one timing programming unit is provided forwarding at least one deadline each in comparison with a clock unit to an alarm or ringing unit and narrowing down, beyond the period of time for the call-up or recall off specific amounts of the drug -variable between temporal limits, which are variable yet determinable.

80. A device according to claim 1 or 2, wherein at least one programming unit is provided determining deviations -being variable yet determinable for the individual case- of measured chemical parameters downward or upward wherein no adaption of dosing from a normal dosage takes place.

81. A device according to claim 1 or 2, wherein a normal dosis for specific periods of time can be determined within a programming unit for at least one type of drug corresponding tp the association to one dosing device and which permits also a correction thereoff according to at least one stepped elective correcting factor in connection with the deviations of the determined chemical parameters from the standard value assessed as desirable..

82. A device according to claim 1 or 2 and 81, wherein at least one programming unit for a

special dosing program within variable dosis limits assessable for the individual case within specifiable time limits can be selectively addressed in the case of the variable yet -for the individual case- assessable parameters being transcended.

83. A device according to claim 1 or 2, wherein the ringing system comprises an acoustic and optical signal transmitter and also a vibrator as such transmitter, which system can be arbitrarily blocked by the patient, the switching on and off being capable to be printed out by a printer.

84. A device according to claim 1 or 2 and 60, wherein wherein switching and delaying means are provided allowing the patient to delay injection until the patient has had enough time to decide, or to break such injection off, the printer such data out also.

85. A device according to claim 1 or 2, wherein a programming automatism lockable as to its function is provided whereby a preset dosing program can be modified if their are a number of disticly diverging measured values with corrections which are an indication of an erroneous setting of dosis.

86. A device according to claim 1 or 2 and 85, wherein the depot insulin dosage for the injection deadline with respect to measured quantities assessed therebefore in point of time, with multiple additions of immediately working or unmodified insulin in keeping with the preset dosage, can be raised in stages; whereas, by falling below the measured quantity, a reduc-

tion of the depot insulin is noted down as future dosage.

87. A device according to claim 1 or 2 and 85, wherein a programming automatism becomes effective, for correcting the dosis setting for unmodified insulin with the cooperation of the patient, which automatism effects, at raised or lowered control data subsequent to a regular injection deadline, a stepwise adaption of the unmodified insulin dosis in the dosing program.

88. A device according to claim 1 or 2 and 85, wherein a program automatism lockable as to its function becomes effective for correcting the setting of the correction factor for unmodified insulin with the cooperation of the patient, which automatism modifies, in accordance with the raised or lowered measured data during the measurement control and subsequent to a deadline to be scheduled by the patient at specified least intervals for injection and prior to a dispensation of unmodified insulin, and to effect such modification in steps or stages.

89.-91 . are missing inadvertently at PCT.

92. A device according to claim 1 or 2, wherein the piston of the step syringe is a type of wax envelope, the frictional abrasion of which being attuned or matched to the conic rstriction of the cylinder.

93. A device according to claim 1 or 2, wherein a pin, as dosing means, is located inside of the tube having rigid walls for outputting the drug, which tube has an inlet channel

to said rigid-walled output, and wherein tubular rings are placed between said drug conveying tube and a fixed envelop which is filled, in part sequentially, by an electrically operated pump with an auxiliary fluid in a manner such the flow of the drug is partially interrupted and the fluid is ousted or displaced in specified amounts in one direction by peristaltic movement.

94. A device according to claim 1 or 2 and 93, wherein the pin is made of elastic material.

95. A device according to claim 1 or 2, wherein a tubular ring is housed about (a pin) in a hose conveying the drug, one tubular ring being located between said former hose and a rigid wall, being filled with auxiliary fluid via an electrically operated pump whereby the drug steam in the hose is stopped.

96. A device according to claim 1 or 2, wherein a pin inside of the drug conveying hose is enclosed by shutter-type lamellas constricted to throttle passage flow by way of piezo-electrical voltage transformers functioning as pressure transducer.

97. A device according to claim 1 or 2 and 93, wherein two double-acting cylinder piston pumps each are electrically operated in such manner that the central one of three tubular rings respectively communicates cavity-wise with the output of both cylinders simultaneously.

98. A device according to claim 1 or 2, wherein at least one electromagnet acts by the short lever arm on plates connected via a hinge or joint thereto, with the drug conveying hose being guided between said crossing short and resilient lever arms in an acuate manner between the plates and via two crossing lever arms still further to the cannula in a manner such that by pulsed actuation same amounts of the drug are conveyed.

99. A device according to claim 1 or 2, wherein a conic envelope having a spiral type interior ledge acts, via an elastic cone with a spiral shaped border ledge -whereon the drug conveying hose is mounted- via electric drive, when lowered upon the hose in such a manner that the upper windings of the hose ar squeezed earlier than the lower one and a peristaltic dosing movement is performed which is blocked by the action of a barrier placed under a hose winding, and this when resetting of the conic envelope takes place.

100. A device according to claim 1 or 2, wherein an elastic envelope or shell sleeve is provided in whose hollow space or cavity a hose enlargement is located whose inputting leg is guided flat above the rim border of the shell or envelope ring, said hose enlargement being connected, on the side of the cover, to a plate which is connected via overlying piezoelectrical pressure transducer so that, when approaching, the inputting hose leg is first pinched off and then the hose enlargement is partially emptied through the cannula, a leght source cooperating with sensor to control the contents level of

the hose enlargement while the stroke height of the pressure transducers is controlled by a piezoelectrical switch.

101. A device according to claim 1 or 2, wherein measuring or test electrodes are provided on the drug conveying hose, the measured data relative to electromagnetic changes of state being transmitted as a function of flow rate to a control unit commanding an electric locking valve, with the drug fluid from the supply reservoir being pressured.

102. A device according to claim 1 or 2, wherein the ends of the drug hoses are formed as hose ends bent at an angle connected to bores of the central supporting tube for the cannula magazine, which bores are conical on their sides.

103. A device according to claim 1 or 2, wherein a central pin adjustable in height inside of the suction cup activates a snap-in device which acts upon the position of the cannula inside of the cannula magazine.

104. A device according to claim 1 or 2 and 103, wherein a central pin adjustable in height inside said suction cup surmounts the suction cup rim prior to vacuum generation and for tripping or triggering same.

105. A device according to claim 1 or 2, wherein connected after a pressure gas capsule is a valve combination comprised of two seat valves, the smaller one of which being opened first, and a slide valve, in terminal position of the slide valve gas pressure is accumulated

in an high-pressure chamber towards the seat valves whereby opening the large seat is facilitated.

106. A device according to claim 1 or 2, wherein a swelling pin, underneath a pressure gas capsule, is housed inside a tube, which pin urges, upon fluid being added, the pressure gas capcule into the mandrel with the groove for gas relief.

107. A device according to claim 1 or 2, wherein a supporting arm with accumulator tube operastes to accomodate used-up cannulas in order to connect a plug-in part for drug replacement to the apparatus via a fixing spindle.

108. A device according to claim 1 or 2, wherein lateral flaps are provided which are closed by spring action used for the control of the operation of the apparatus while indicating, at same time, the operating conditions.

109 A device according to claim 1 or 2, wherein in the vicinity of the cannula a cylindrical pump housing(111) is interconnected without break by sections of said hoses, possibly of material composition thereof or unimpeded expansion from outside, in which housing a rod (110) is embedded with rod drives alterningly a seal member(109,163) and a valve lock(115, 169), the power being provided from said disk (112) perforated with passages for the liquid of the drug or preparation and effected at the rod via a clamping device(113,171) and the linkage(122,126) thereof by a motor, the number of pumping strokes of said rod for the respective injection being determined by means of a mechanism for preprogramming the dosage, and

said injection being triggered as soon as the skin in the suction cup is lifted or raised.

110. A device according to claim 1 or 2 and 109, wherein said seal member at the rod is comprised of a collar(109) directed against a plug (114) through whose central bore the rode penetrates towards the cannula and which bore is closed by means of a projection(115) of the rod with the counter stroke for having the collar bear against said punger.

111. A device according to claim 1 or 2 and 109, wherein said pump housing(111) proper is formed by said hose(44) limited as to expansion by the inflexibility of the internal compcsition of the material or from outsinde by fixing envelope(116).

112. A device according to claim 1 or 2 and 109, wherein the motor is constituted by a spiral(31) acting on two wheels(117,125) rotable about said pump housing, which wheel comprising each circular profil ridges or ledges facing one another to which resilient(121,127) rods(122,126), acting as sensors and guarded against rotation with respect to the axis of said pump housing, communicate their stroke travel to the disk(112) at the valve rod within said hose(44).

113. A device according to claim 1 or 2 and 109, wherein said motor constituted by a solenoid(170) whose spring-back resilient pendulum movements are transferred to said disk(112) within said hose(44), the number of pulses for respectively one injection being presettable in a unit (175).

114. A device according to claim 1 or 2, wherein the drug supply reservoir(20) is constituted by bellows whereabove a cover is disposed, which cover can be adjusted in height, which displacement being coupled via a power transfer mechanism(132 to 137) with the moment for for the pump in keeping with a presettable dosing in such manner that the amount of drug fluid delivered through said cover corresponds to that displaced by said pump.

115. A device according to claim 1 or 2, wherein said drug reservoir is constituted by said bellows supplied within a gastight vessel with gasifying reagents, the manner in which said reagents are kept relative to one another causing a delayed and gradual delivery of gas, and a pressure relief valve being provided on said vessel so as to keep the pressure on said drug fluid nearly constant.

116. A device according to claim 1 or 2 and 115, wherein for gas production a bicarbonate compound is brought up to a sheeting or foil, which will be exposed to the influence of hydrochloric acid inside of a gas pressure container, said foil being piled up in thin layers.

117. A device according to claim 1 or 2, wherein a control line is provided between the drug reservoir in the direction towards the cover, which line causes on account of the decrease in size of the drug reservoir an alarm to be tripped shortly before the drug supply will be exhausted.

118. A device according to claim 1 or 2, wherein a program may be provided within the unit(175) for electronic control of presettable dosing so as to actuate the alarm prior to an exhaustion of supply, and to block the function of the injector in a recognizable manner as soon as the dispensation of the next dosis is no longer assured.

119. A device according to claim 1 or 2, wherein an adjustable obstacle(142) is provided so as to prevent the cover(138) to descend further briefly before the supply has been exhausted and to block conjointly therewith the functioning of the injector.

120. A device according to claim 1 or 2, wherein for the preservation of negative pressure a vacuum source is provided by a member adjacent to the suction cup and part of a cylinder(5) with cover, and wherein sensing means (69 to 74) are provided on the injector so as to detect an altered surface due to subsiding negative pressure on each cylinder subsequent to skin contact, which alterations control the continued operation of the working cycle of the injector.

121. A device according to claim 1 or 2 and 120, wherein said sensing means are constituted by a feeler(74) mounted as angle bracket on a drum (71) lifted up by a rammer(69) of lengthwise flattened cross section against a spring with the rim of said vacuum preserving or retaining cylinder(5), wherein said drum is rotated by the action of a connecting link guide(72) therein on a fixing or g[illegible] pin(73) in such a manner

that said rammer abandone its seat on the cylinder wall and a notching in the contactor pin(66) extending the axis of said drum and comming to rest above a wedge(75) with said feeler pivoting to the cover membrane(6) of said vacuum retaining cylinder(5) where it descends upon immersion and because there is no longer support by the pin(7) about the cannula shaft from said border membrane(10) to said suction cup, the notching in the contactor pin being descended in the vertical in keeping with said connecting link guide and actuating said wedge for further tripping the functions of the injector.

122. A device according to claim 1 or 2 and 120, wherein bellows(96) are squeezed by a rammer(69) resting on the wall of a vacuum preserving cylinder(5) when it is raised by sliding the cylinder(5) into the injector, air streaming into the pneumatic cylinder(98) via line(101) and a nonreturn valve and descending the piston and hence also the rod of the slide valve(99) penetrating into the windows(85) of the elastic membrane on the otherwise fixed cover membrane of said cylinder(5), resetting however said slide valve again, when lifting the window membrane as a consequence of the subsiding vacuum or negative pressure in said cylinder(5) subsequent to pressure compensation, towards the suction cup occluded by the skin, whereupon said bellows are reventilated via said opened slide valve and said line(100) so that the drum(71) totable connected thereto descends in keeping with its connecting link guide on the fixing or guide pin(73) and causes said wedge or drop-in pin(73) to be tripped such that said injector proceeds with its operation.

123. A device according to claim 1 or 2 and 40, wherein said injector supports locking means (148,149,154,155) for the bottom cover(9,165) comprising attachment means(165,207,208) therefor, which are removed in keeping with the provisions and prior to the applying said injector after said locking means of the injector have become oper ative.

124. A device according to claim 1 or 2 and 123, wherein said locking means of the injector are comprised of locking lamellas(149) parts of which, being excentrically, mounted with an axis(155) each on a ring(146) fixed relative to the injector with the rotation of a control ring(154) connecting an axle pin(158) each therewith, are displaced in the direction into and out of the notching(150) in the region of the annular piston or said bottom cover(9) of said cylinder(5) preserving the vacuum.

125. A device according to claim 1 or 2 and 124, wherein said control ring(154) is rotated against a spring from three pins(148) in the suction cup range for actuating said locking lamellas(149), which pins being lifted beyond activating the tripping or release action of said locking lamellas within their passage past and through said control ring.

126. A device according to claim 1 or 2, wherein the rotation of the control ring(154) unblocks from three pins in the suction cup range or area the openings for the release or tripping tabs(187) above said control ring in such a manner that by having the latter descend the continued functions of the injector will be tripped or triggered.

127. A device according to claim 1 or 2 and 40, wherein the tripping pins(148) for the continued functions of the injector are located within bays or indentations of a clover-lobe shaped suction cup rim external of the suction cup chamber.

128. A device according to claim 1 or 2 and 40, wherein said suction cup is formed at least in part by the injector whereinto said vacuum preserving cylinder(5) sealed with respect to said suction cup will be pushed or slid.

129. A device according to claim 1 or 2 and 41, wherein the injector is provided with spring-suspended contactor buffers(81) acting on a cover membrane(6) projecting over the wall of said vacuum preserving cylinder or vacuum reservoir cuplet(5) for assuring fixation thereof.

130. A device according to claim 1 or 2 and 41, wherein the locking means of the injector comprise locking pins(204) acting through thinwalled bulges(206) of said vaccum preserving cylinder(5) in a manner so as to lock the movement of the support cylinder(205) supporting the border membrane(10), on which cylinder a centrally pierced bottom cover(165) laterally projecting above the border membrane is attached with its central part, while the rim extending alongside of a predeterminded breaking ring (208) and supporting the wall of said cylinder (5) is removed prior to the injection.

131. A device according to claim 1 or 2 and 41, wherein a hoselet(209) closed by a clamp(210) extends from the adapter funnel for the cannula

adapter piece of the injector, which funnel projects somewhat above the cover membrane(6) of the vacuum preserving cylinder or said vacuum reservoir cuplet(5), to a small ball for checking the vacuum as well as the position of the cannula with respect to the blood vessels.

132. A device according to claim 1 or 2 and 40, wherein the suction source comprises a resistance heated boiler(172), wherein the heated air may escape through the valves(184) and the vacuum may be preserved until the valve opens between boiler and suction cup chamber for sucking up the skin.

133. A device according to claim 1 or 2 and 132, wherein said boiler is subdivided into a plurality of chambers(174) with separate valve means for each individual chamber.

134. A device according to claim 1 or 2 and 132, wherein said boiler(172) comprises a double-walled cylinder the lower portion of which encloses said suction chamber.

135. A device according to claim 1 or 2 and 40, wherein for the reventilation of said suction cup chamber a tripping mechanism is provided whereby the tension of a spring(64,104,105) is arranged for prior to the standstill of the motor effecting the delivering or dispensation of the drug fluid, a locking member(59,99,159) being retained by a grid(58,62,108,160,161,163) for so long until said locking member at the steep flank(162) of the fixed housing link unblocks the movement by said spring(64,105) subsequent to the delivery or dispensation of the drug fluid.

136. A device according to claim 1 or 2 and 40, wherein said mechanism for reventilation the suction cup chamber comprises a mandril(89) having a tripping bar(60) which is raisedor lifted against the action of a spring when the vacuum preserving cylinder(5) is pushed or slid in so as to pierce the cover membrane (6) of said cylinder(5) upon actuating said tripping mechanism.

137. A device according to claim 1 or 2 and 40, wherein said mechanism for reventilating the suction cup chamber comprises a slide valve(99) communicating via a hose(156) to ambient air, wherein the tension of said spring(105) is produced by the pressure effect of a tongue(82) or tab, having been moved past it, onto the wedge slant of a valve rod(106), and wherein the housing of the slide valve(99) is displaced against the compression spring(104), a locking mechanism(108) preventing the return of valvercd into a valve open situa tion for such a lenght of time until said slide valve effects snapping engagement of said locking mechanism(108) by said tongue or tab under the action of said spring(105) subsequent to passing the wedge slant whereby effecting the return of said valve rod under the effect of said spring(105).

138. A device according to claim 1 or 2 and 40, wherein the tension of the spring(105) for returning the valve rod via an elastic manual lever(161) is effected, while the slide valve (99) is closed, against the action of said spring(105) and abutment on the disk(225) displaced conjointly with the discharge of the drug, whereupon by the descending the manual lever into an abrupt constriction of

the connecting link at the housing the follower (163) will snap into the bore of said disk(225) and will first unblock the movement of said spring(105) after the manual lever has returned via its steep flank of its link at the housing by having said manual lever spring upwards, said spring(105) effecting via the hose(156) a reventilation of said suction cup by displacement of the valve rod.

139. A device according to claim 1 and 3, wherein a cannula shaft, behind the ground surface and sustaining ring closure thereof , is opened duct-like, the lacking wall being replaced by an inlay of synthetic material and endowed with sensor properties.

140. A device according to claim 1, 2 and 3 with a cannula which has a hoslet inside so shaped that its end leaves the cannula shaft by influence of fluid pressure.

141. A device according to claim 1 or 2, wherein counter wheels are present which are rotated by the movement her to and from of a pinion respectively to the frequency of use and the blocking of whose effects the blocking of the function of device by a stop.

142. A device according to claim 1 and 2, wherein said cannula is developed as optical sensor by introducing light through the cannula shaft, which is reflected at a incicator layer, being altered in such a manner that alterations of metabolism are identifiable by means of a detector.

143. A device according to claim 1 , 2 and 142, wherein polarized light is introduced through the cannula shaft, which is led about a mirror into a detector.

144. A device according to claim 1 , 2 and 142, wherein the light is introduced through light transducing fibres into said cannula.

145. A device according to claim 1 and 2 and 142, wherein the light is projected directly by an opening of the cannula shaft and received again through that.

146. A device according to claim 1 and 40, wherein polarized light is projected and reseived inside of a suction cup nearly to the cannula through the skin which is raised.

147. A method for manufacture of a vacuum retaining cylinder or reservoir cuplet(5), characterized in that in two form parts(215) of an injecting mould there are formed vacuum retaining cylinders and annular pistons(9) side by side, carrying them via transport means(211,212,213) of the annular piston first to a border membrane (10) -cutting and bonding same-, affixing attachment means(165) at the annular piston and finally bringing together said annular piston and attachment means with the border membrane in a seal housing comprising a cylinder(5) having a fixed cover membrane(6) as second part, removing extensively the air from said seal housing via a pump and uniting both parts with the border membrane as joining surface by bonding such that after removal of the vacuum retaining cylinder cuplet said attachment means prevent the annular piston from sliding into said cylinder.

148. Medico-technical device for the automatical injection of fluids under the skin of man or animal, in particular for the injection of insulin in treatment of diabetes. The injection device thereby consistes of:

a) a proper injecting syringe, which again consists essentially of a syringe cylinder and a syringe piston and a supply container,

b) of means for determination of the concentration of the respective values of blood (respectively of the deviation form the normal values) of the living beings (man or animal), there particularly means to determine the glucose concentration of blood of patients suffering from diabetes which need treatment,

c) means for the calculation of the amounts of fluid which is need according to the measured and from the normal values deviating values of blood, there particularly for the calculation of the amounts of insulin which is needed for the treatment of the measured sugar contents of blood,

d) means for the dosing of the fluid amount and of providing in the syringe cylinder, there particularly means for the dosing of insulin,

e) means to introduce the fluid under the skin of the living being, and is

s i g n i f i c a t e d t h e r e b y ,

that a cannula which serves to introduce fluids together is developed ad sensor-changor which as intended after the introduction of the cannula onto the body of the living being determinates the concentration of the questioned components of body, particularly of status of metabolism (e.g. glucose-contents) inside of the body by means of physico-chemical change of conditions.

149. Injection cannula as claimed in
Claim 1, 2 and 148,
s i g n i f i c a t e d t h e r e b y,
that the sensor surface of the cannula serves as as an active electro-chemical element in connection with the body liquid of a living being and by means of a counter-electrode.

150. Injection cannula as claimed in
Claim 1, 2 and 148,
s i g n i f i c a t e d t h e r e b y,
that the sensor surface of the cannula alters its electrical resistance in a legal manner and in such which may be reproduced by the influence of the body liquid of the living being, and whereby is available for evalutation either a voltage proportional to this resistance, repectively the alteration of said voltage with the times, or the current intensity proportional to said resistance, respectively the alteration of said current intensity with the times.

151. Injection cannula as claimed in
Claim 1, 2 and 148,
s i g n i f i c a t e d t h e r e b y,
that a sensor is present at the cannula, wich decides the concentration of the questionable body liquid by means of light-conducers, wich are taken with within or at the cannula and such by photometric way.

152. Injections-device according the dominating notion of claim 1, 2 and 148,
which contains a means of the
production of a negative pressure at the body surface which is to treating(so-called "suction cup"),
s i g n i f i c a t e d b y

auxiliary aggregates with the assistance of those is secured, that
a) the ejection of the injection fluid under the skin events first after the building-up of the negative pressure is concluded,
and that
b) the reventilation events first after the the injection is performed, and that automatically, and whereby the suction cup rim serves as counter electrode during the measurement.

153. Injection device as claimed in Claim 1 and 152,
s i g n i f i c a t e d b y
a computer building-stone with aid of which the dosing and the injection of fluid events automatically after the (pre-)programming and starting of the program.

154. means according claim 1 and 148 (especially 1c) for
the calculation of the amount of fluid which is needed for the injection,
s i g n i f i c a t e d b y
a) an input measuring unit for the reception and processing of the signals delivered from the sensor cannula,
b) a program unit (with time donator) for the (pre-)programming of commands,
c) a computer unit for the evaluation of dates given from the sensot and from the program unit and
d) a command-unit for the transmission of the resultats of calculation as commands toward the dosing device.

155. (Pre-)programming unit according Claim 1 and 154b,
s i g n i f i c a t e d b y
adjustability of a predestinated "normal" dose.

156. A device according to claim 1 or 2, wherein means are present for supervision of the exhaustion of drug supply, these means as to activate an alert or alarm device and as to lock the functions of the device, if the delivery of a sufficiently dosis no longer is guaranteed.

157. A device according to claim 1 or 2, wherein means are present to set in swingings or to vibrate the dosing device, at least said hose section which is nearly to the cannula, and this for blending or mixing the compounds of the drug or medicine.

158. A device according to claim 1 or 2 and 41, wherein the reventilation of said suction cup results through a nozzle or jet.

159. A device according to claim 1 or 2 and 41, consisting of a housing cylinder(1), a bottom or basic ring, a folded bellows which extends from the proximity of the latter towards a piston, of a tube tube socket for connection with a push-in or inserting cylinder for taking up an injection syringe, whereby a reventilation valve exists and a device for a temporary blocking of backward movement of said piston as to unfold again said folded bellows, after the interior space of latter have been connected with a suction source through a drain or derivation hose and the skin of the patient have been closed .

160. A device according to claim 1 or 2 and 159, wherein a tent-like membrane is provided between a central sliding tube and the piston as to render possible a backward movement of said sliding tube and the syringe even though said piston has been fixed.

161. A device according to claim 1 or 2 and 159, wherein said inserting cylinder contains a sliding shell, which lifts the syringe by a predetermined extend out of the range of the suction cup rim by means of a spring, which syringe on the contrary will be sunk towards the suction cup by pressure effect from the piston which is moved by the effect of suction.

162. A device according to claim 1 or 2 and 159, wherein a piston ring is fastened on said piston, which ring bears magnets which are adjusted towards the iron covering plate of the inserting cylinder wherewith these may be touched.

163. A device according to claim 1 or 2 and 159, wherein pegs are mounted in a transversal bore or cross-bore which are moved by means of a slant in a blank of the housing cylinder and the notch of the sliding tube for locking of the piston movement.

164. A device according to claim 1 or 2 and 40, characterized by an injector composed of a foldable drug supply bag and of a support or carrier disk(40) constituting means for adjusting the delivery of the drug or preparation through the hose in accordance with a preselected variable dosing thereof, which support disk carries two facing rollers(41), surrounds said hose(44) in a recessed chamber, squeezing said hose against

an annular encircling abutment(43) with said rollers, and is provided with a sectoral passage, said hose outside of said passage being surrounded by an expansion-resistant envelope (45) up to the cannula(8) within the suction cup, the power source for the displacement of said carrier disk being constituted by a spiral spring, the displacement being effected via a locking toothed wheel or ratchet with pawl(30) in the pressure tension release means of said spiral spring, resilient tabs(27) constituting the stops as means for presetting the dosage prior to the application, and which stops being settable along a scale or graduation whereby said carrier disk is prevented to come in contact with a contactor pin(66) which is withdrawn for a short period of time through a profile link(67) subsequent to a sectoral motion of the disk(51) driven by special spiral spring(55) and part of the vibrator means, which disk hold regularly spaced pins engaging the annularly traversing wedge profile ridge or ledge(76) alongside of the carrier disk and communicating thereto thrust-type motions transverse to the axis as soon as it has been lifted into the cannula after suction has been exerted on the skin within the suction cup.

165. A device according to claim 1 or 2 and 159, wherein, if said inserting cylinder approachs to the suction cup, a pin shoves against a contact spring which thereby contacts with the cannula shaft.

166. A device according to claim 1 or 2 and 164, wherein at least two hoses are arranged parallel on the carrier disk and reunited in front of the cannula attachment piece.

167. A device according to claim 1 or 2 and 164, wherein means(48,88) have been provided whereby a fold-free housing or lay-out of the hose is assured within the grooved chamber(288).

168. A device according to claim 1 or 2 and 164, wherein roller pairs facing one another squeeze the hose together.

169. A device according to claim 1 or 2 and 167, wherein a tension spring(48) extends as safety means from the hose exit away from the passage of the annular abutment(43) to the housing.

170. A device according to claim 1 or 2 and 167, wherein threads extend rope-ladder like between the hoses(44) about the stationary bridge(88) of a gear wheel.

171. A device according to claim 1, consisting of at least one temperature feeler arranged in such a manner that differences of temperature can be ascertained in the area of the skin knob.

172. A device according to the claims 1 and 2, consisting of at least one temperature feeler for comparing differences of temperature at the state of a blood-less skin with a such of blood-fullness.

173. A device according to claim 1 consisting of a photometric measuring arrangement with at least one ray source and at least one sensor for checking differences of density at the area of the skin by comparison of the extent of the ray absorption.

174. A device according to the claims 1 + 173 wherein said ray source emits polarized light for checking of conditions of metabolism at the area of the skin.

175. A device according to the claims 1 + 173, wherein at least one reflex-photometric measuring arrangement is present.

176. A device according to the claims 1 - 173, wherein a plurality of emitters vertically arranged work against sensors vertically arranged too, in such a manner that the raising and stop- of motion of the skin knob may be ascertained .

177. A device according to claim 1 + 173, wherein a plurality of emitters which are vertically arranged work against senscrs which are vertically arranged to for checking the thickness of skin layers by evaluation of differences of density and absorption.

178. A device according to the claims 1 + 173, wherein at least two emitters are arranged with a distinct angle shifting preferably with such of 90 degrees for checking the possibility of the presens of a blood vessel by the simultaneously decrease of the ray intensity.

179. A device according to the claims 1 + 173, wherein the distinction between different substitutes of the skin is facilitated by the choice of the kind of rays.

180. A device according to the claim 1+177, wherein simultaneous measurements of a plurality of sensors are provided, to find out the thickness of the skin layer after the stand-still of the skin knob is ascertained by the pattern of alternation of measuring data by means of different extinction of rays tangentially projected or radiated through the skin knob

181. A device according to the claim 1 +177, wherein the subsequent alterations of light absorption by at least two sensosr are used to check the thickness of the skin and whereby the velocity of the skin raising is included for evaluating, measured by the comparison of the at the time at which the skin knob passes a beam.

182. A device according to the claims 1 +172, wherein the comparison of measurements of a sensors, which also may be arranged horizontally, takes place using the characteristic of the change of measurements by regularly distanced sensors to check the density, number and extent, of vessels by calculation

183. A device according to the claims 1 +173, wherein the comparison of the measurements by at least two nearly positioned sensors by computer elements is used to check an exceptional limitid density under the skin with the aim to break off the elevation and the subsequent functions of the device.

184. A device according to the claims 1 +173, wherein the skin has a fixed relation of position towards at least one measuring arrangement, at least partially working tangentially to the skin knob to coordinate the known distances of the ray path through the skin area with the measured extinctions.

185. A device according to the claims 1 +173, wherein at least one second measuring arrangment is provided with fixed angle shifting, as to a calculatory coordination of of the interception points of rays of different arrangements for localisation of irregularities of ray extinctions.

186. A device according to the claim 1, wherein changes of measuring values in the area of at least one sensor is used, to interrump an injection under the skin and to actuate a warning device.

187. A device according to the claim 1, wherein between a handle grip of an injector with functional constituens and a suction cup exists a spring connection, tensioned during an approximation of both parts by manual pressure, while adjustements of their surface common together prevent movements outside of their common axis, but said spring keeping in distance both parts if the manual pressure is released, all this

to avoid a reventilation of the suction cup by tilting by means of the lever effect caused by the length of said handle grip.

188. A device according the claims 1 +177, wherein the handle grip is replaced by a kind of over beaker which sourrounds the injector cup-like.

189. A device according the claim 1, wherein a suction injector is used with at least one switch between the outern suction cup rim and inner rand zone destinated for latter abuttment of the raised skin, which is activated at a first step by skin contact, but which startes the injection not earlier as when the skin contact is interrupted again during the reventilation of the outern sealing area at a second step.

190. A device according to the claims 1 +189, wherein instead said switch at least one channel opening communicates with a kind of suction switch, the backwards movement of which activates the triggering mechanism for the dosing pump.

191. A device according to the claim 1, wherein a suction injector has inside of its housing opposite to the drug container an accomodating cylinder to receive an replaceable suction cup so that its supporting plane towards the skin is enlarged.

192. A device according to the claims 1 and 20, wherein said replaceable suction cup is a vaccum reservoir cuplet, whereby said injector has at least one dropping lever which can be activated by the same adjusting ring which also serves to the pre-adjustement of the dosage.

193. A device according to the claims 1 +192, wherein the dropping mechanism is activated by a over-taking mechanism inside of a clearance for the motion of the adjusting ring, said dropping mechanism being slidable arround to a dosage spatium together with a lever for the dosage stop.

194. A device according to the claims 1 +191, wherein a device for photometry can be plugged in an atleast partially transparent vacuum reservoir cuplet arround its circumference.

195. A device according to the claims 1, wherein a dosing pump exists in the area of the drug discharge from the fluid container which pump is integrated into the hose and consists of a ventil mechanism which releases periodically alternating the discharge and afflux to a dosing chamber inside of said hose in this area laying inside of a solid pump housing the pressure gas bolster of which presses against said hose wall whereby the pressure of said bolster falls short of the pressure inside of said drug container so that the drug is discharged into the body as mettered single dosages.

196. A device according to the claim 1 +195, wherein the end of the rod of said dosing pump enters through the drug-outlet of a supply container blocked there inside of a bush which is embedded at the bottom of the niche of a folded bellows to be fixed there with its end cone by a spring when said niche was descended with exhaustion of the drug.

197. A device according to the claims 1 -196, wherein said pump rod wich is embedded in said hose has a sharpened point to pierce a sealing membrane bordering to a vacuum reservoir.

198. A device according to the claim 1, wherein a suction injector has a vacuum reservoir cuplet which has arround the cannula shaft a bush closed by an elastic membrane towards the outer air and wich towards the cuplet cylinder is kept at first by an untractile membrane enabled to crush by pressure against the bush, whereby air enters into the space beneath said membrane bordered by a second but compliant membrane, which also extends from said bush to said cuplet cylinder and which is moved by the influence of the manual pressure and by the effect of air pressure in the direction away from the cannula tip whereby a cover plate with a cutting edge works cutting against said bordering membrane, so that the skin is enabled to raise into the cannula.

199. A device according to the claims 1 -198, wherein a border membrane has an adhesive layer to support the raising of the skin.

200. A device according to the claims 1 -42, wherein the support of a sealing border membrane has a central bush with a rotable abutting disk with outer projections abutting against corresponding inner projections of the cuplet, whereby at the injector at least one lever consists effecting the revolution of said abutting disk, after which the bush is drawn upwards by the effect of air pressure.

201. A device according to the claim 1, wherein a storage of pressurized gas is connected by a nonreturn valve with gas storing compartment therefrom being a pressure regulating valve towards the elastic bag for a drug supply , all that as components of an suction injector.

202. A device according to the claim 1, whereby inside of a step syringe for multiple use the separation piston includes a little dosing piston which displaces drug fluid towards the cannula by periodical strokes said separation piston being prevented also periodically for movement by cross-pins struggling against the cylinder wall of said step syringe by a conical portion of the rod of said little dosing piston, which is driven by a solenoid.

203. A device according to the claim 1, whereby inside of a step syringe the separation piston is partially sourrounded by a hose ring which is periodically filled with auxiliary fluid by a little pump, so that said hose ring lockes, first, the lowering of said separation piston and displaces than a mettered volumen of the drug towards the cannula.

204. A device according to the claim 1, wherby within an injector a dosage mechanism is used with one motor for the dosing of two different drugs, said motor running in opposite direction for each dosing mechanism which operates only in one direction while the other one is locked by a ratched wheel and pawl.

205. A device according to the claim 1, whereby inside of a drug container with a folded bellows as isolating supply bag at its end a tape-measure is fastened which leads behind a window of the cover as to indicate the state of filling always

The claims defining the invention are as follows:*

1. A device for the automatical self-control of metabolism of a mammal, consisting of at least one sensor which is to be connected with a measurement device and which is arranged in relation to a skin knob produced by a mechanical dilatation in such a manner that an additional disorder of the body may be avoided for the measurements.

2. A device for the automatical self-control of metabolism of mammal, consisting of a sensor arranged at least near to a cannula which permits to measure alterations of metabolism without accessory injury.

3. A device according to the claims 1 and 2, wherein the cannula itself is developed as sensor to prepare alterations of the metabolism in the body for the information.

4. A device according to claim 1, 2 and 3, wherein special insulating zones with respect to conductivity are provided between cannula shaft and the duct-like opened shaft.

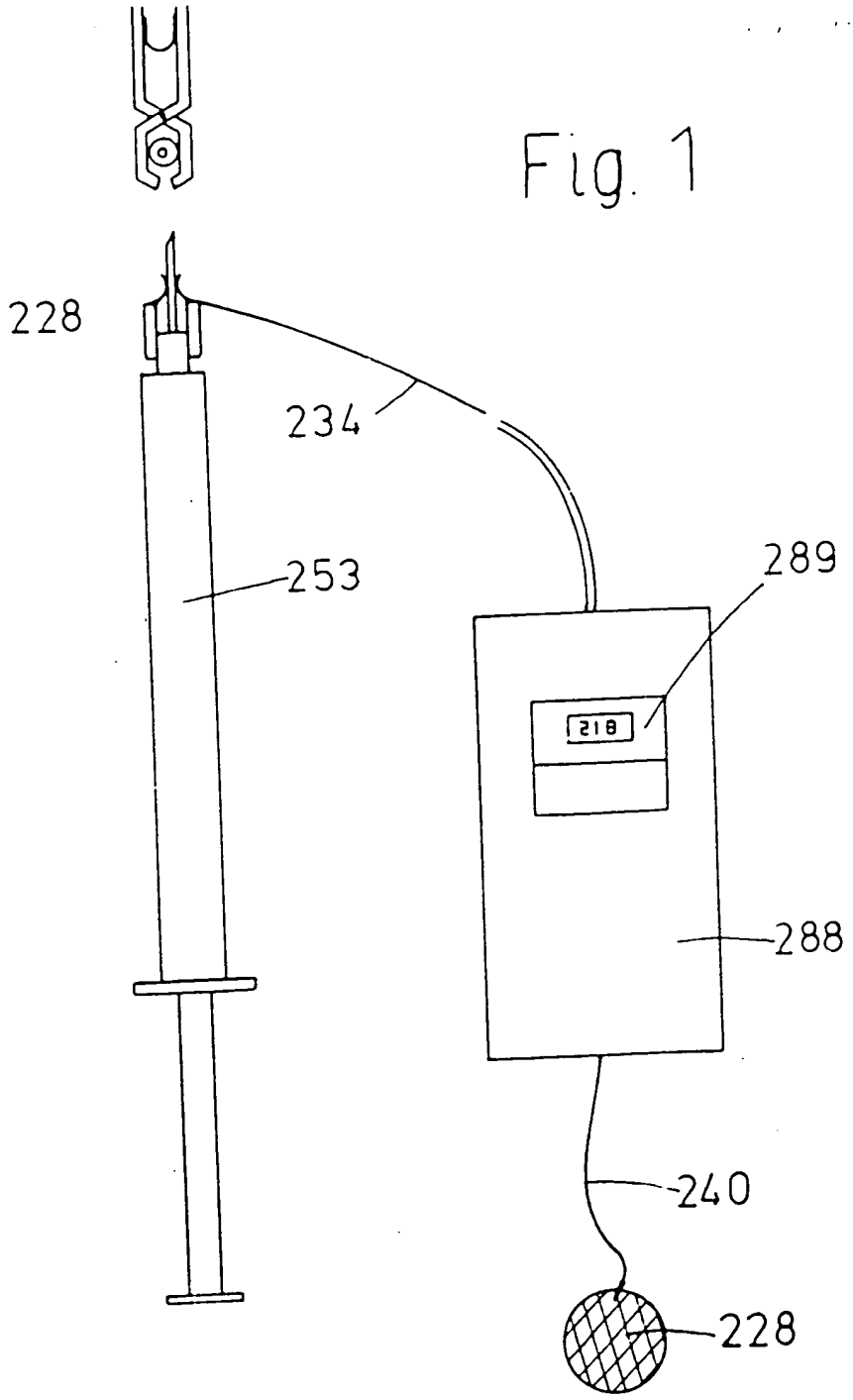
5. A device according to claim 1 and 2, wherein a smal hose having sensor properties is attached on at least one portion of its surface, and this in tight connection with the drug feeding channel within the duct-like opened shaft.

Dated this 19 th day of March ,1986 WAGNER

WOLFGANG NAME OF APPLICANT
(BLOCK LETTERS)

*Note: If there is insufficient space above to type the statement of claim, do not use this sheet, but use separate sheets of paper beginning with the words "The claims defining the invention are as follows:" and ending with the date and the name of the applicant in block letters.

Fig. 1



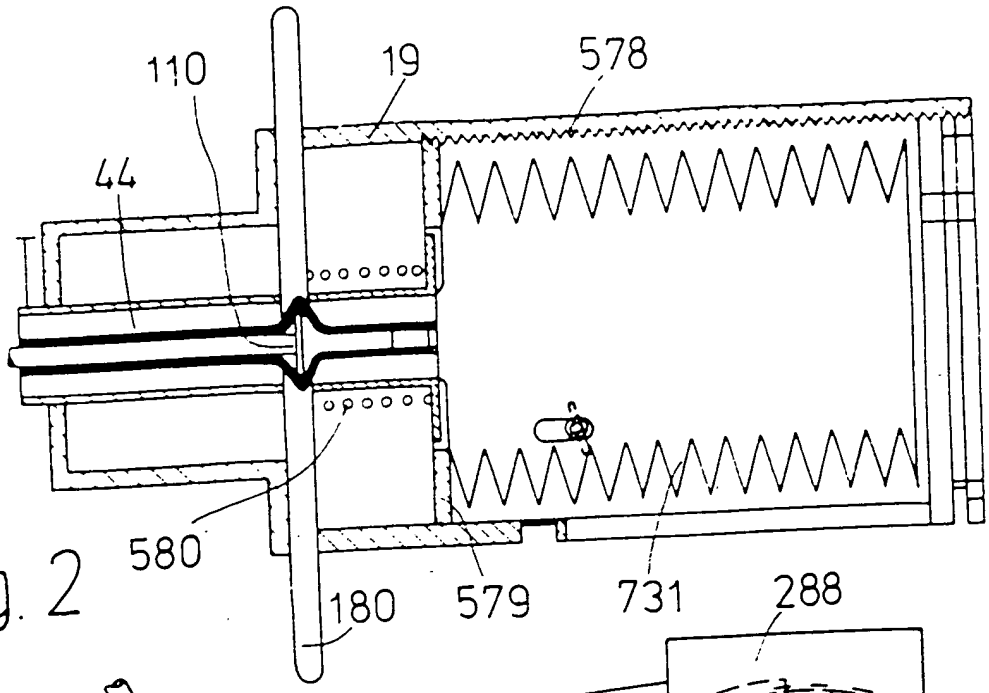


Fig. 2

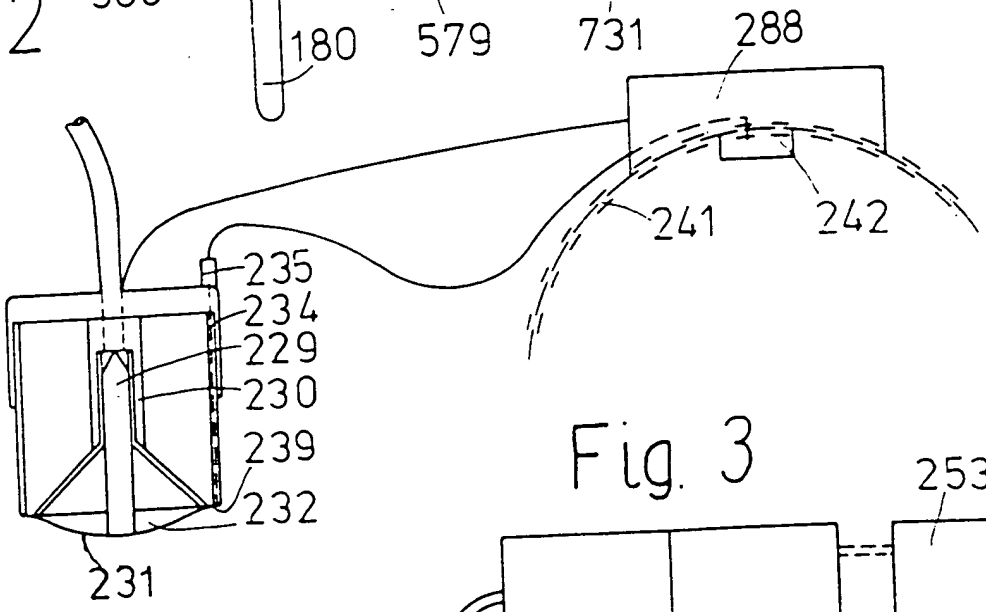


Fig. 3

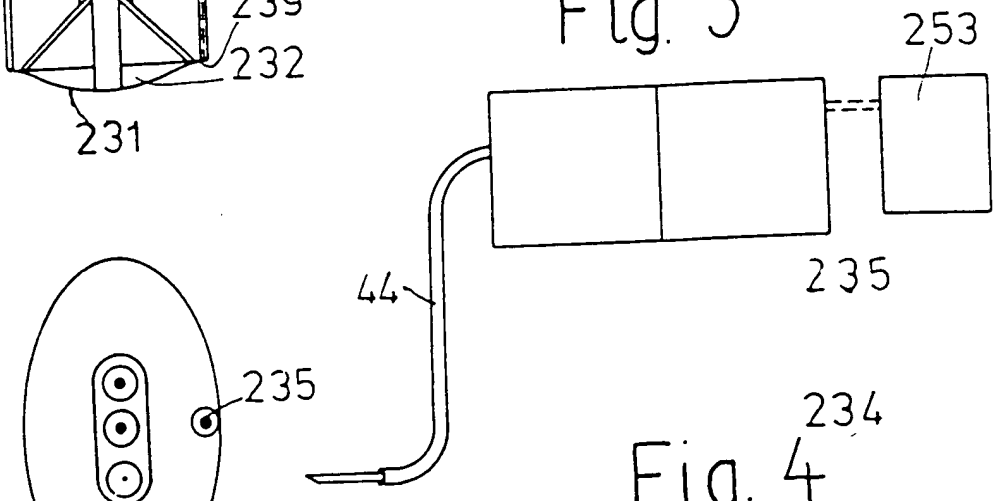


Fig. 4

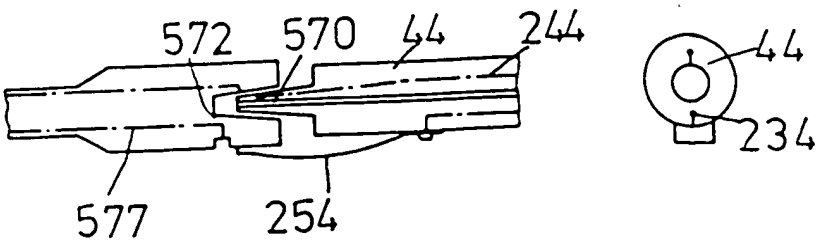
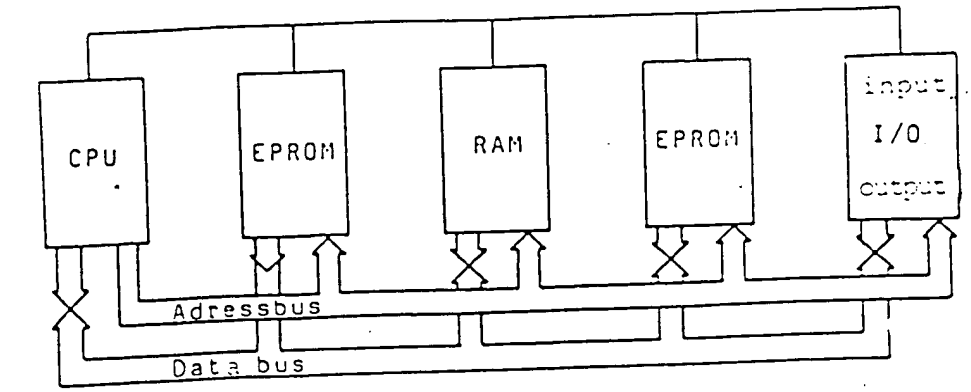


Fig.5


CPU
EPROM
RAM
EPROM
input
I/O
output
Adressbus
Data bus

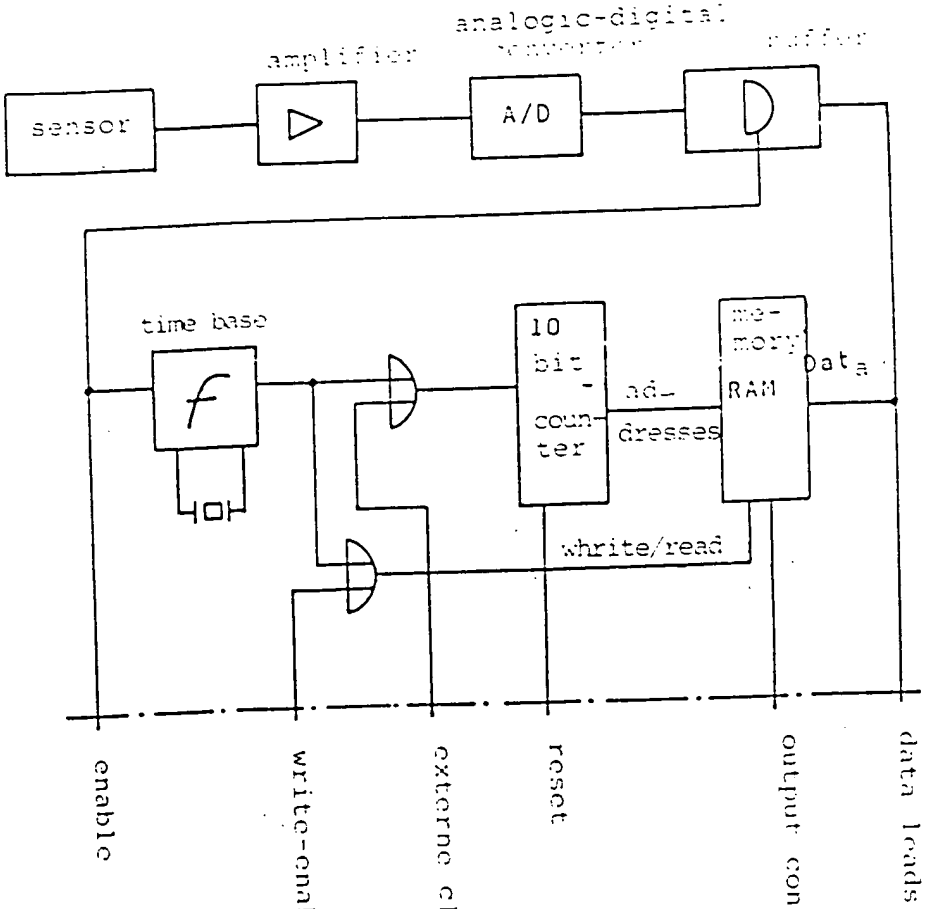

amplifier
analogic-digital
sensor
A/D
time base
f
10
bit
-
coun-
ter
ad-
dresses
me-
mory
RAM
Data
write/read
enable
write-enable
externe clock
reset
output control
data leads

Fig.6

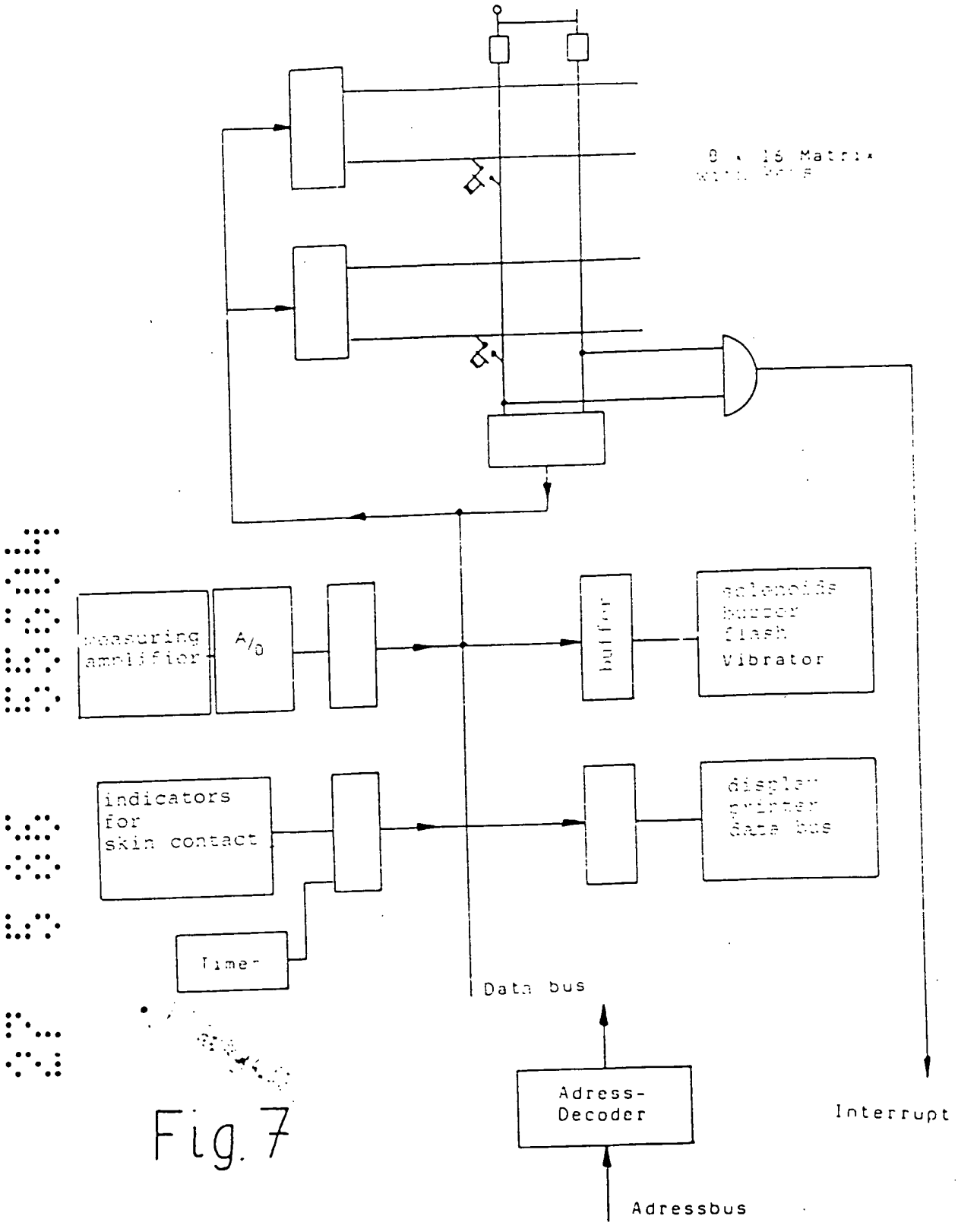

8 x 16 Matrix
measuring amplifier
A/D
buffer
solenoids buzzer flash vibrator
indicators for skin contact
display printer data bus
Timer
Data bus
Adress-Decoder
Interrupt
Adressbus

Fig. 7

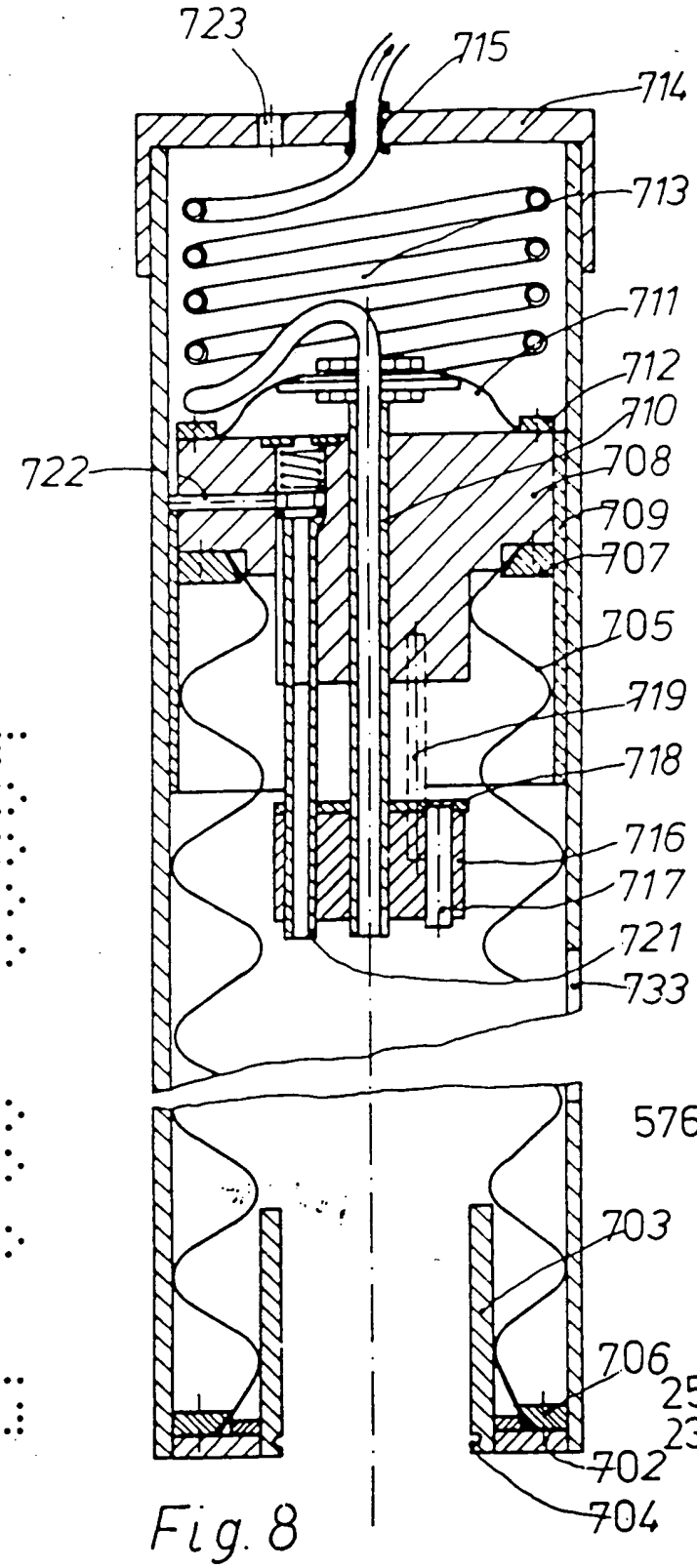


Fig. 8

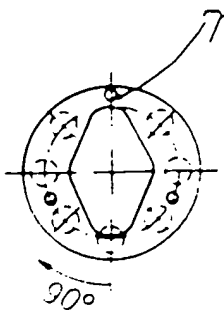


Fig. 10

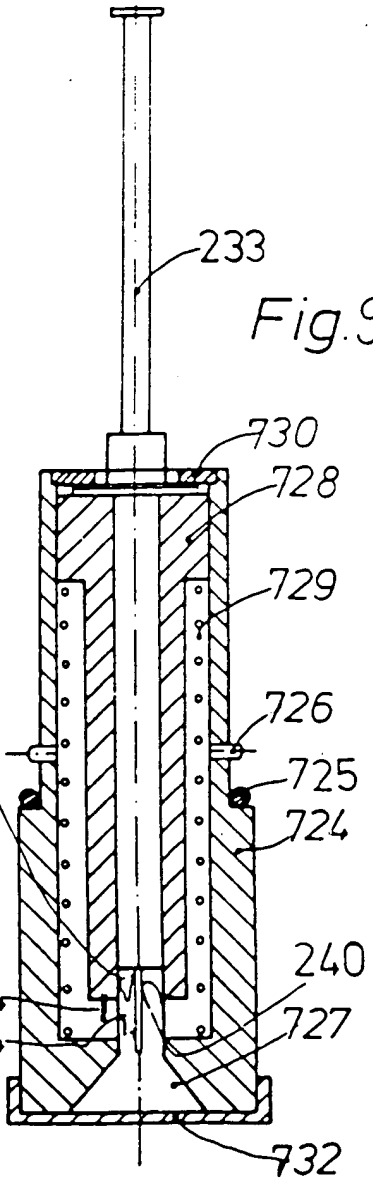


Fig. 9

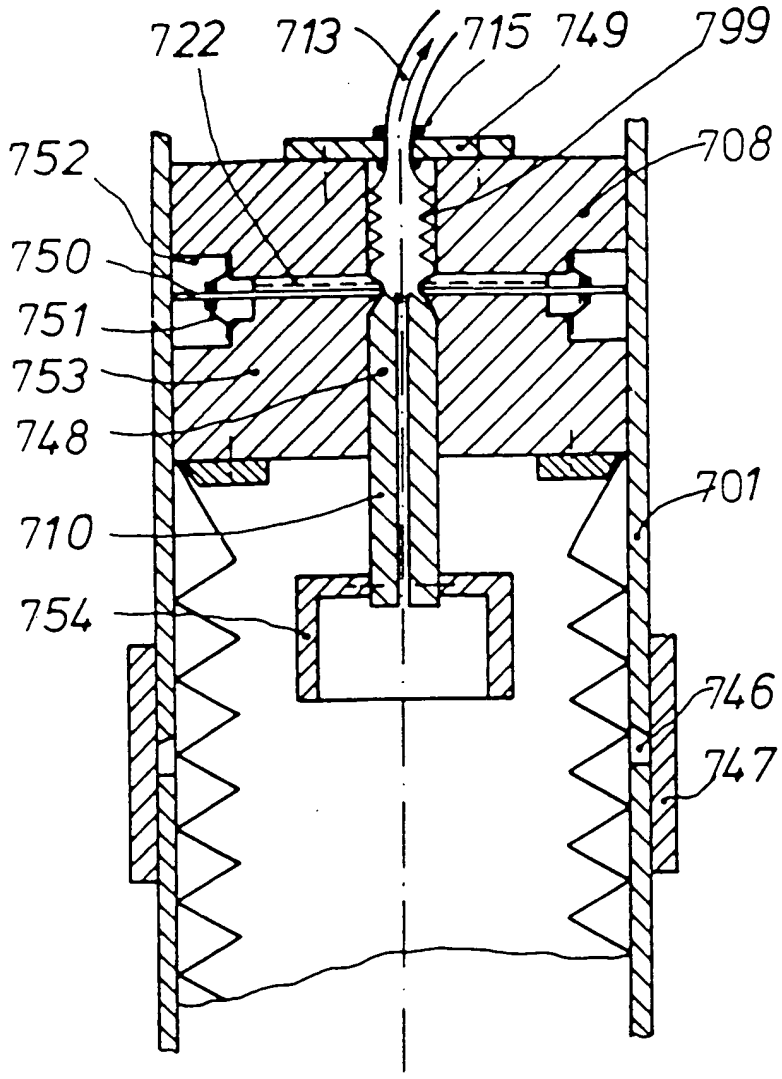

722
713
715
749
799
752
708
750
751
753
748
701
710
754
746
747

Fig.11

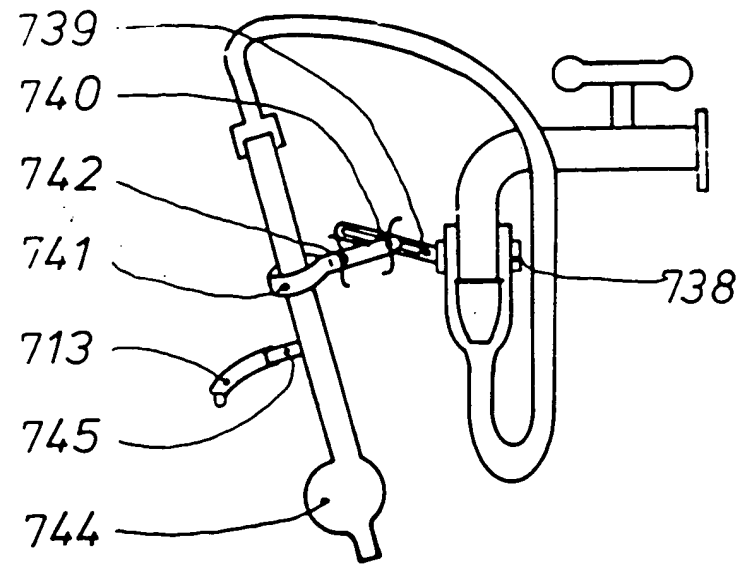
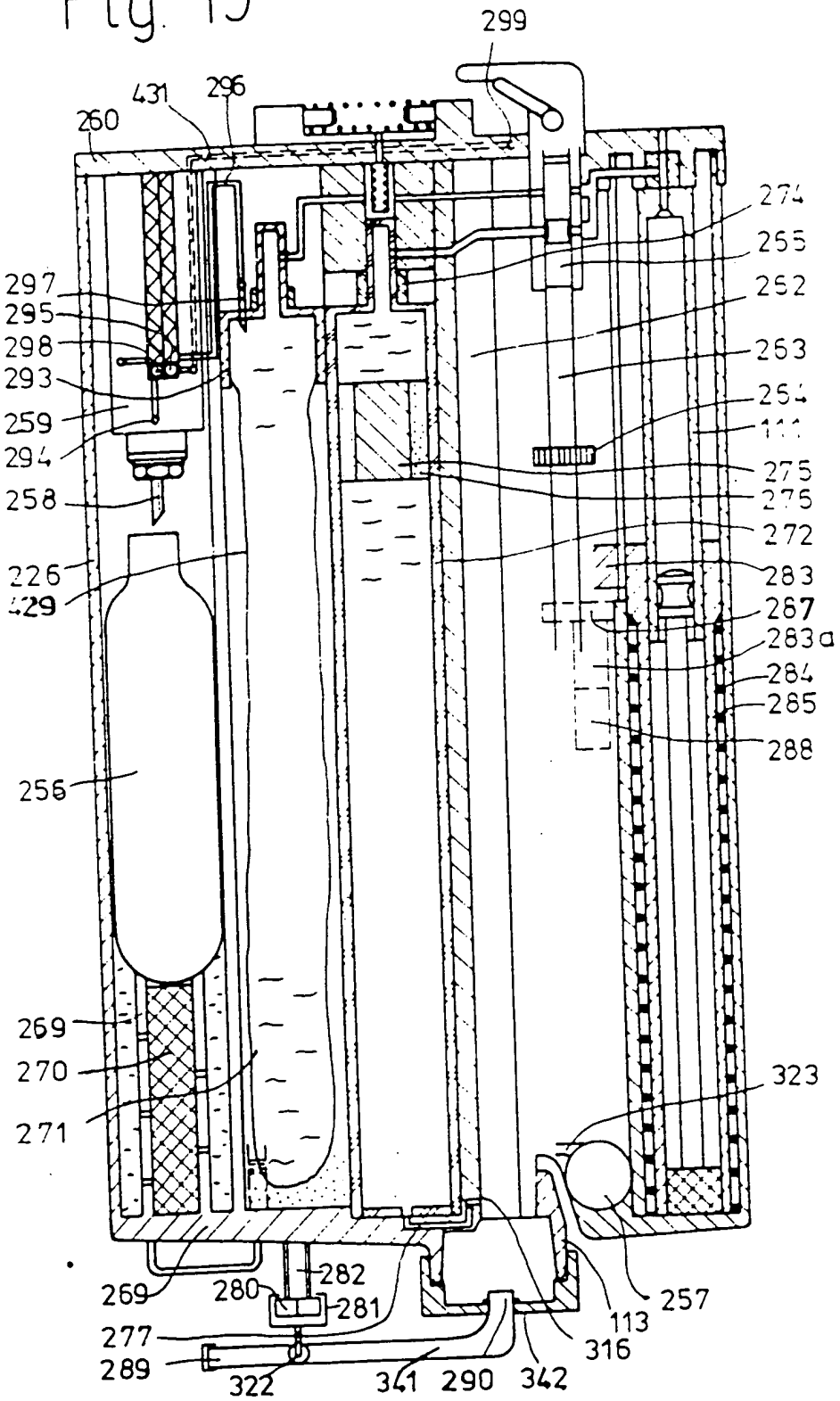

739
740
742
741
738
713
745
744

Fig. 12

Fig. 13


299
431
296
260
274
255
252
297
295
298
293
253
254
259
294
275
258
276
272
226
429
283
287
283a
284
285
288
256
269
270
323
271
269
280
282
281
257
113
277
316
289
322
341
290
342

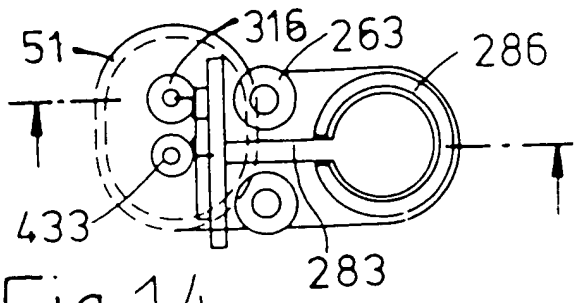


Fig. 1.4

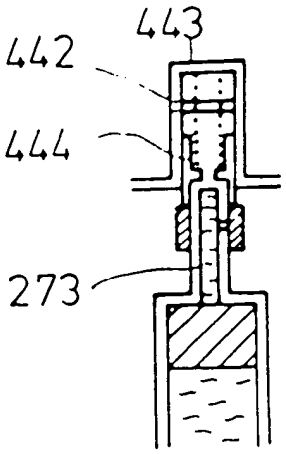


Fig. 16

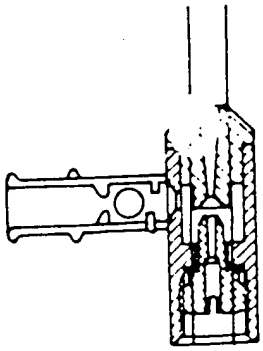


Fig. 17

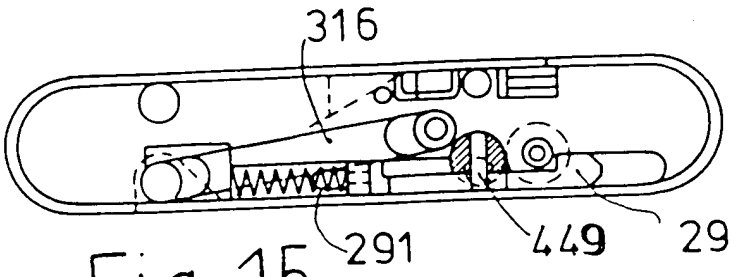


Fig. 15

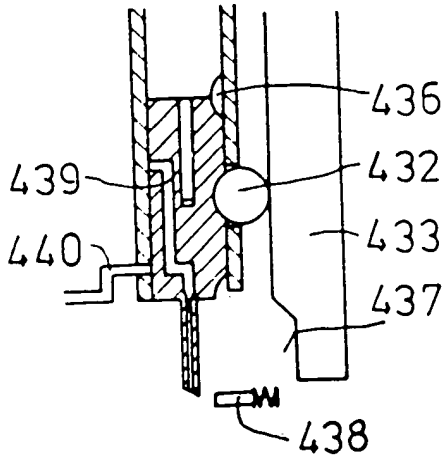
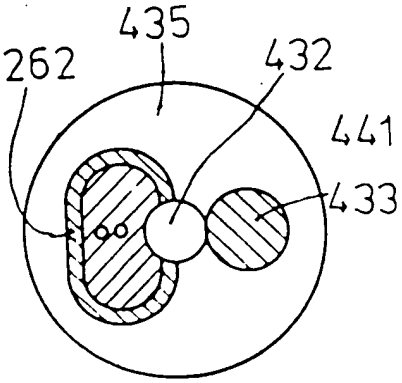


Fig. 18



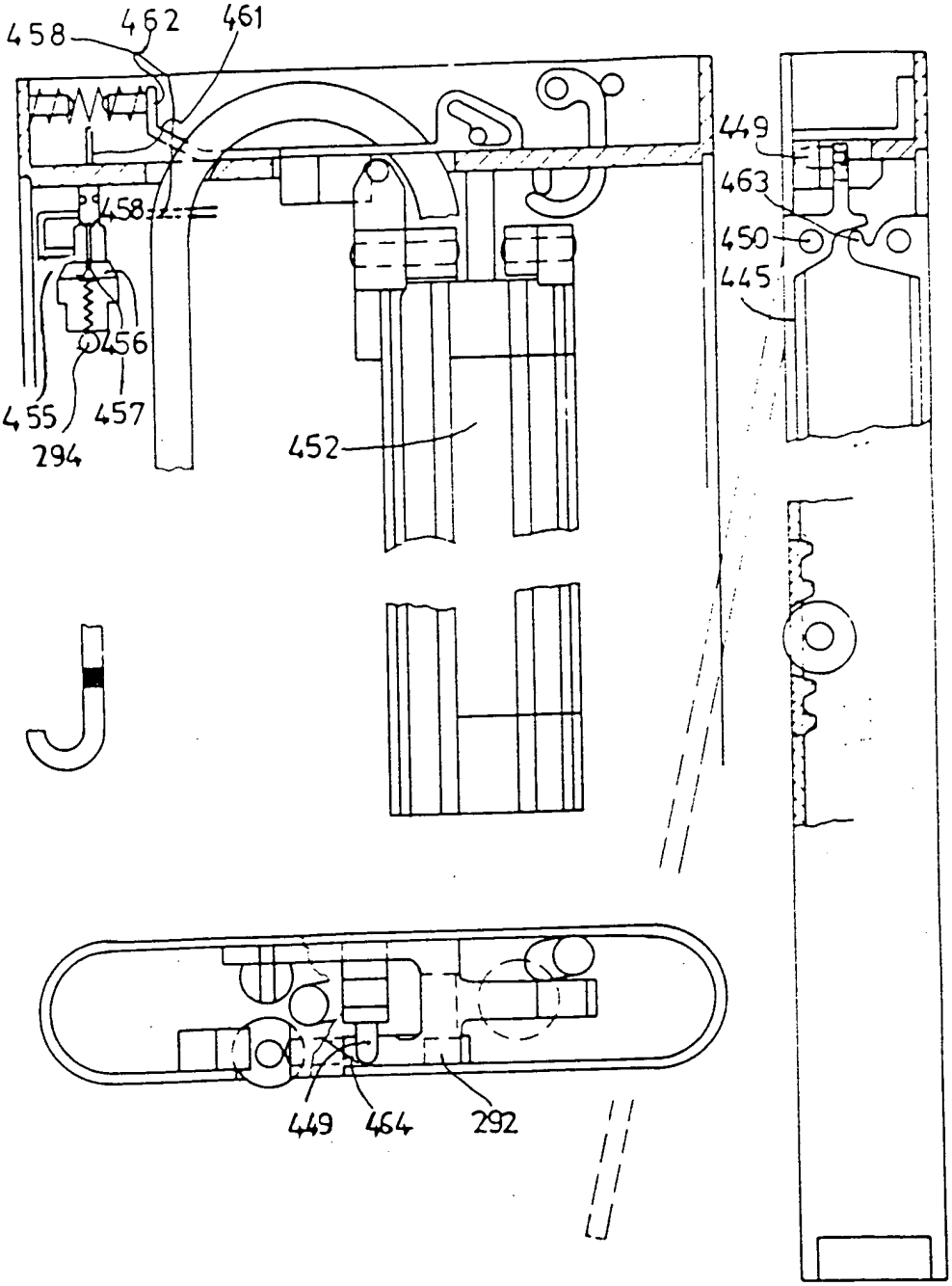


Fig. 19

Fig. 20

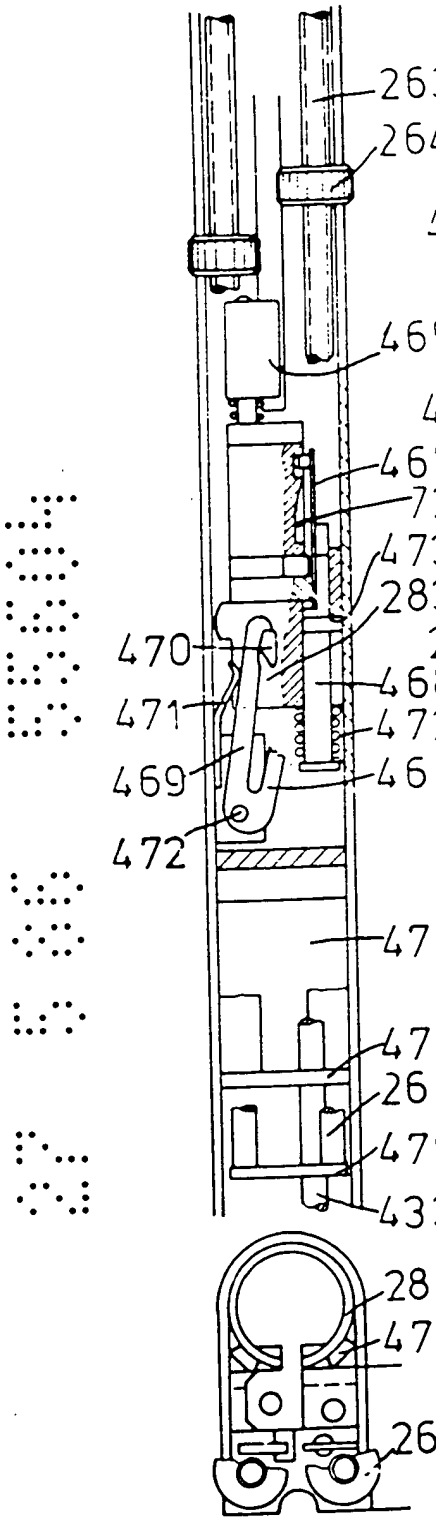
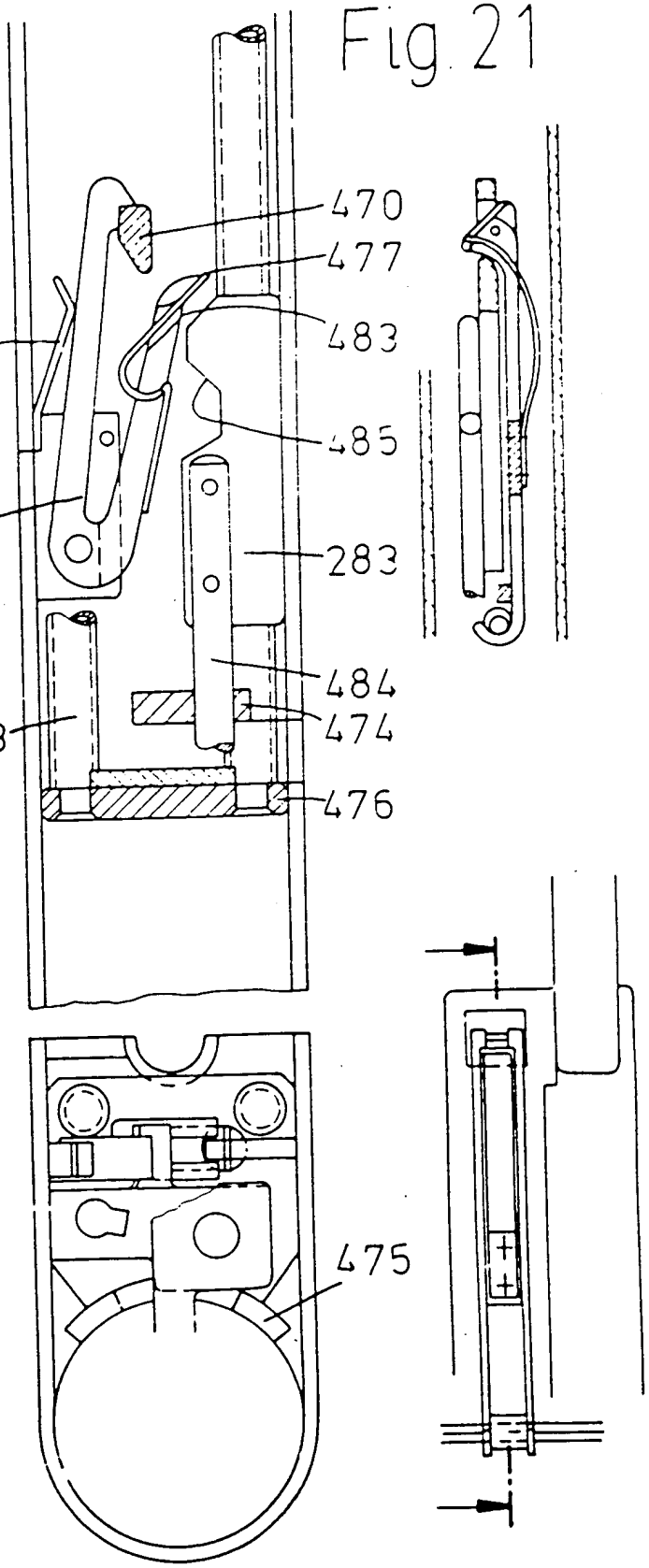

263
264
465
467
72
473
283
470
468
471
472a
469
469
472
475
474
263
476
433
286
475
264

Fig. 21


470
477
471
483
485
469
283
484
263
474
476
475

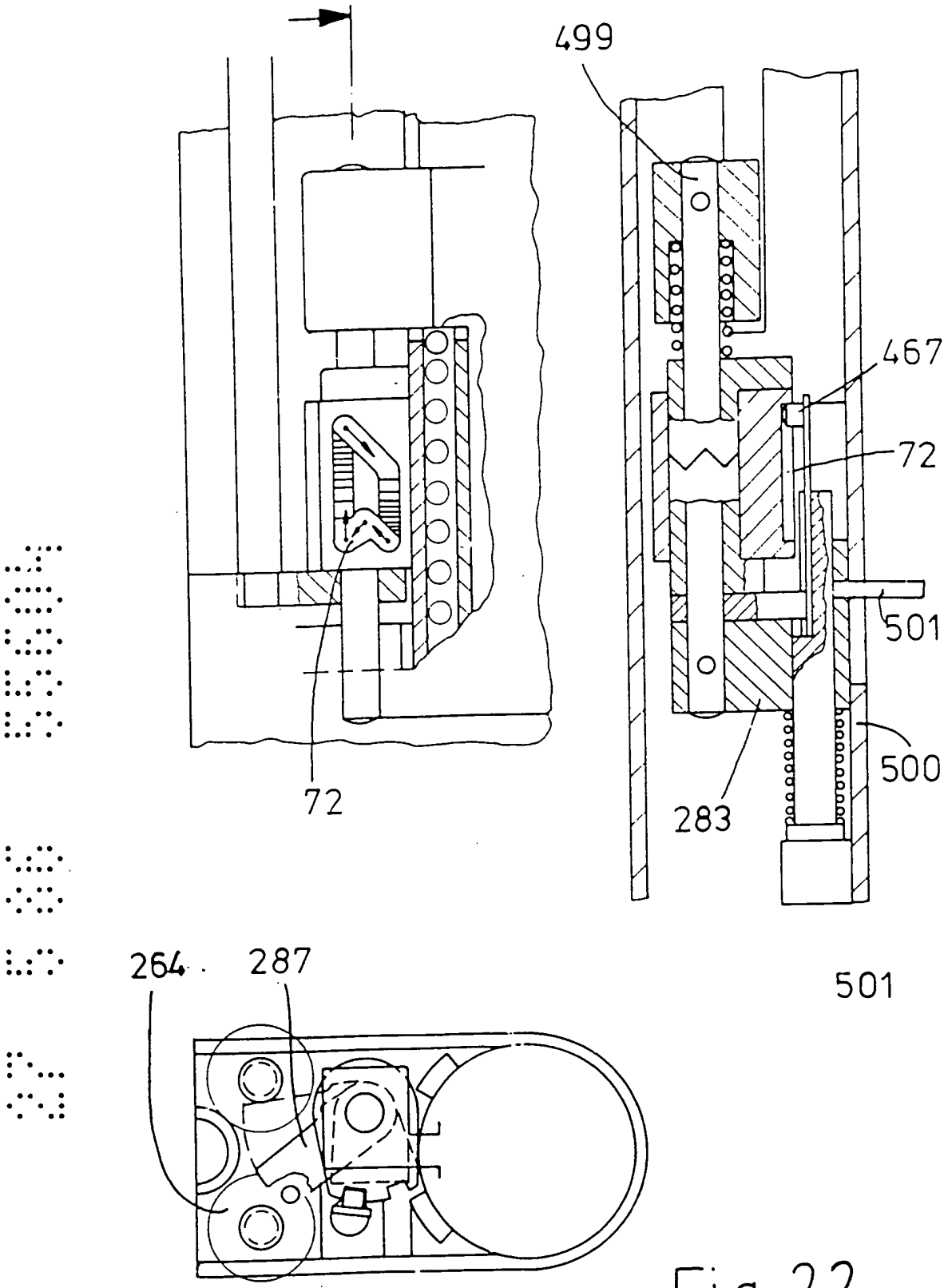


Fig. 22

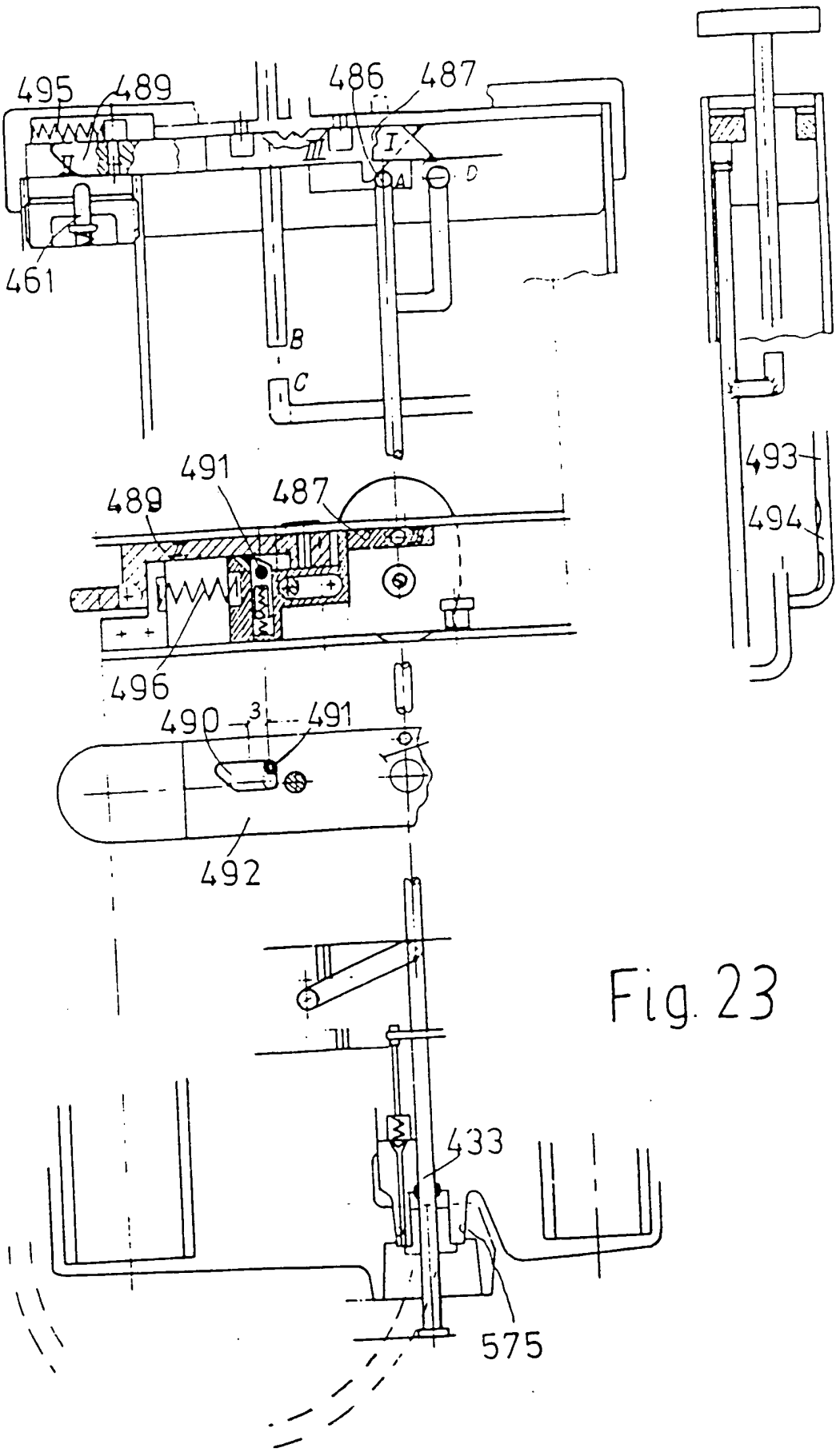

495
489
486
487
I
III
A
D
461
B
C
493
494
491
489
487
496
490
3
491
492
433
575

Fig. 23

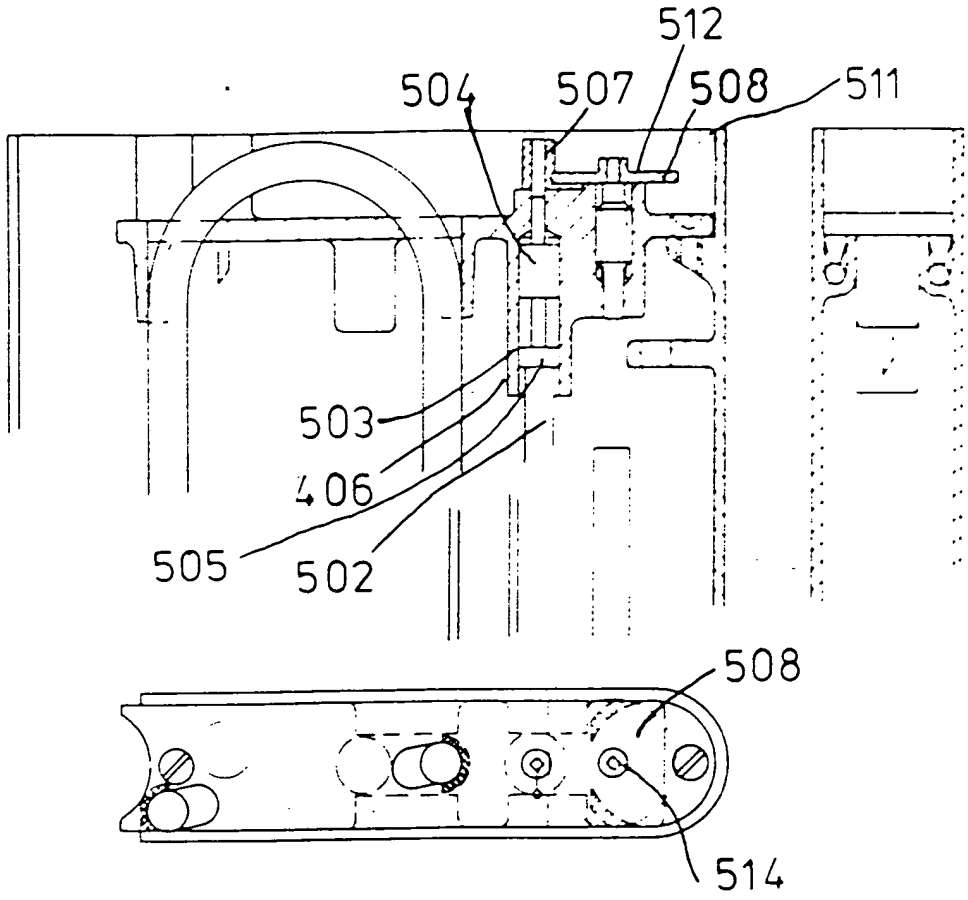


Fig. 24

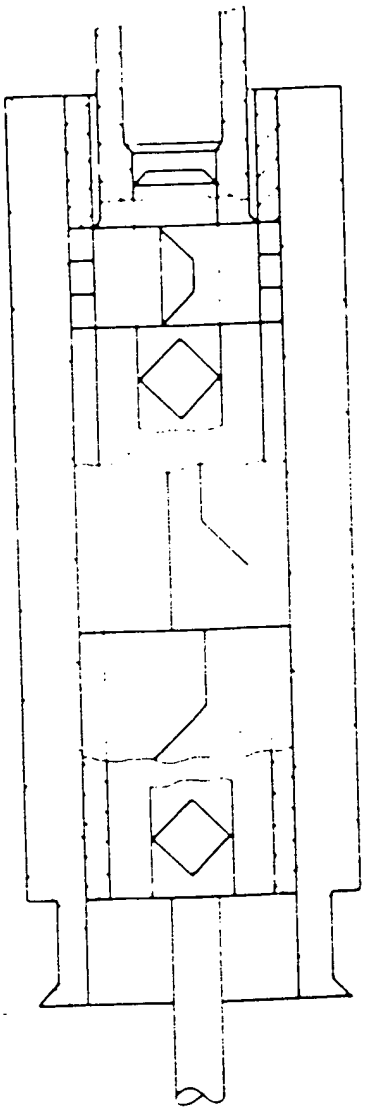


Fig. 25

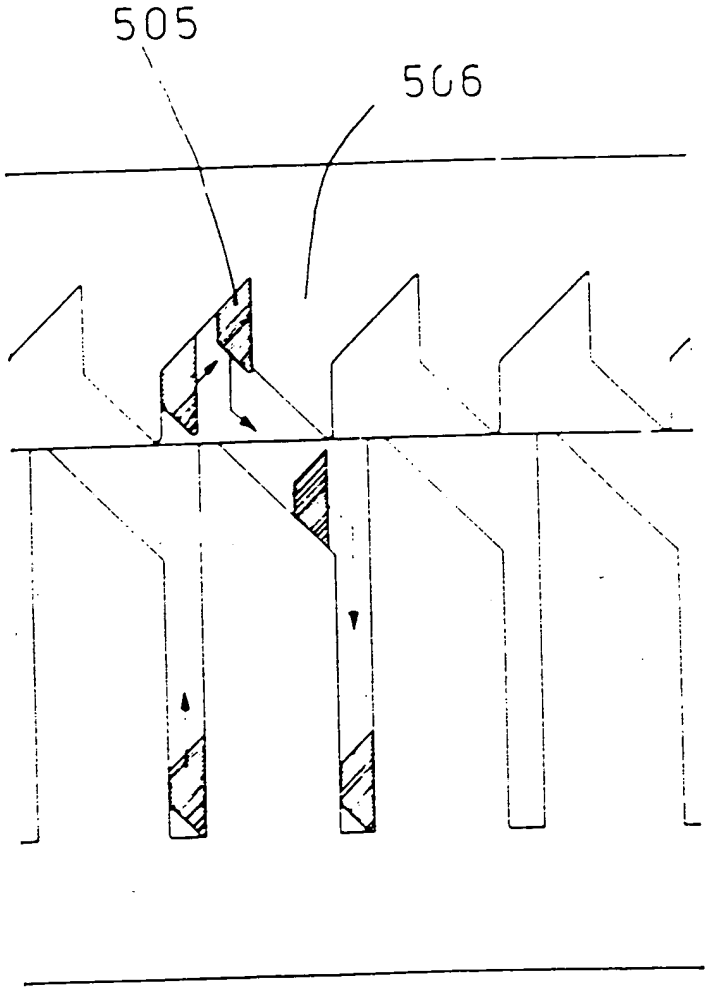


Fig. 26

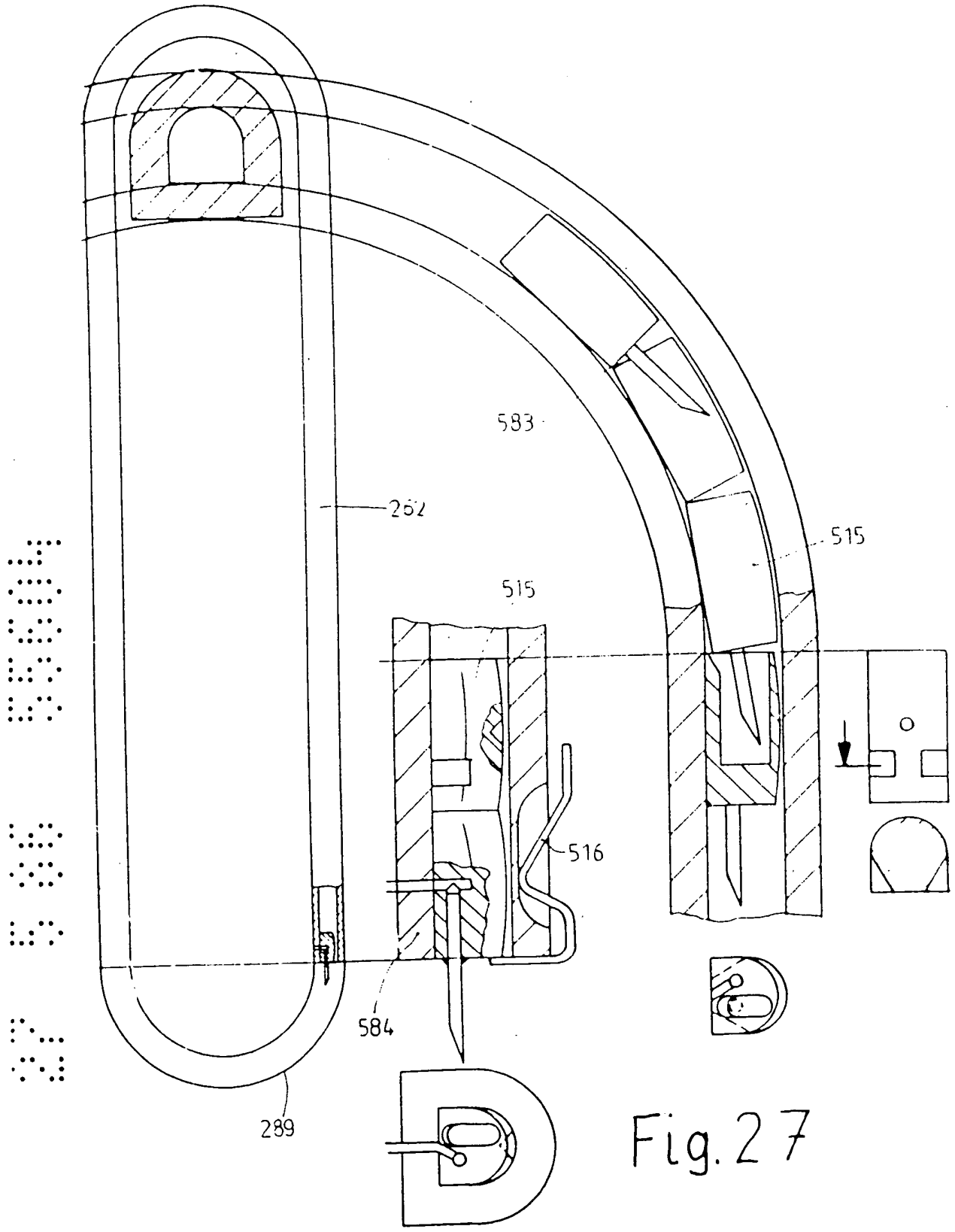


Fig. 27

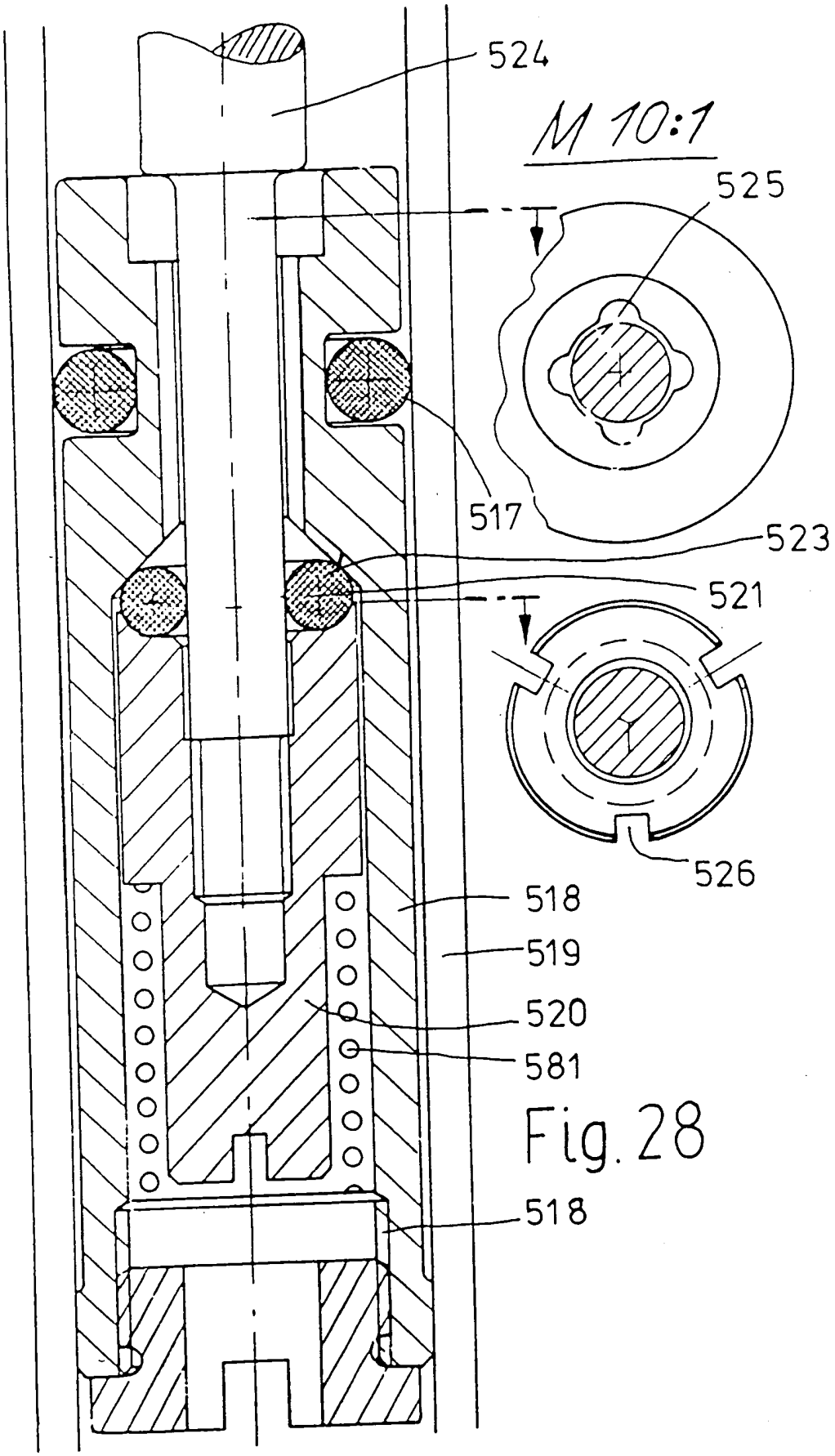


Fig. 28

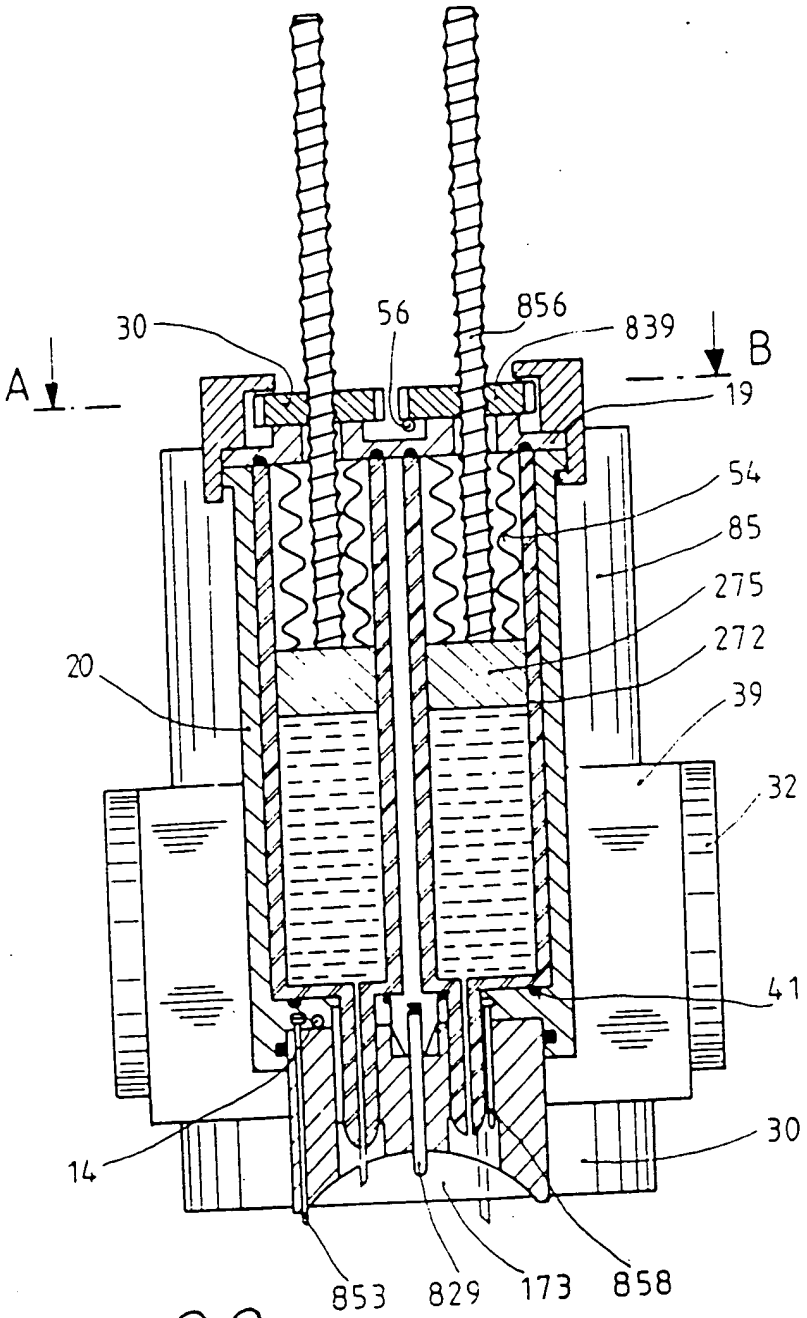
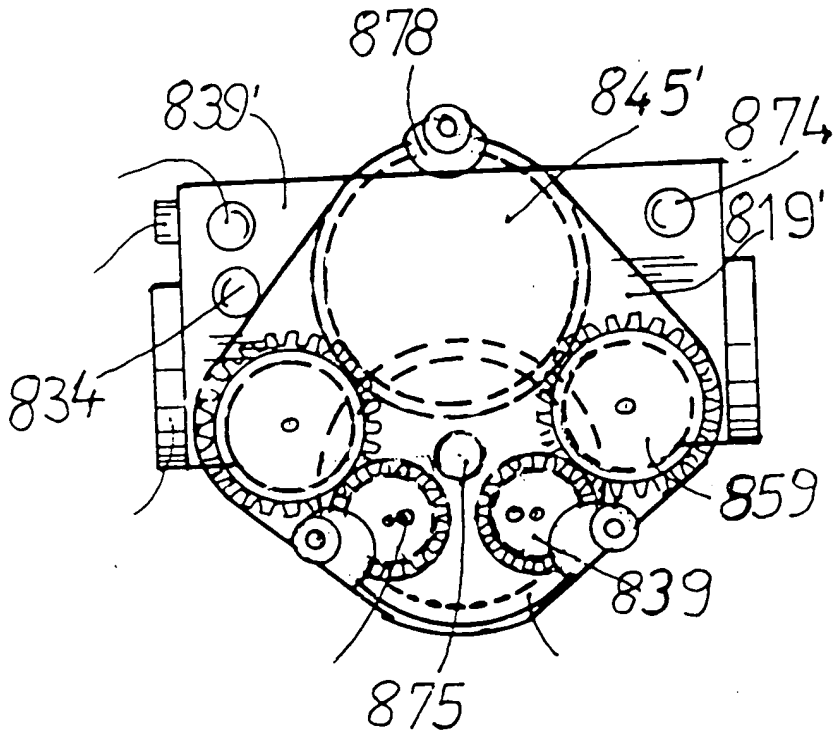
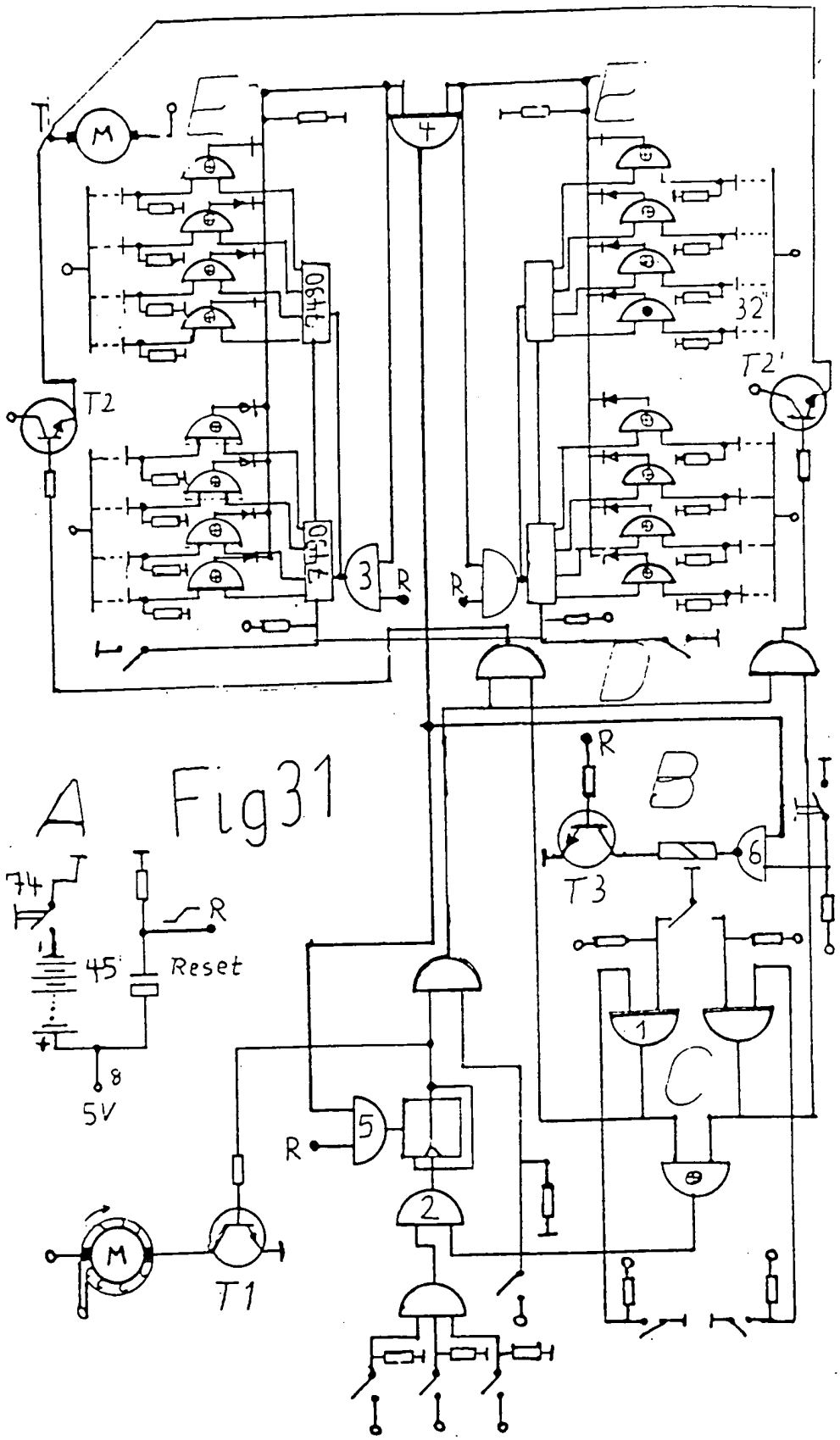


Fig.29

Fig. 30




T1
M
E
4
74190
T2
3
R
32
T2'
D
R
B
T3
6
A
Fig31
74
45
R
Reset
8
5V
1
C
5
R
2
M
T1

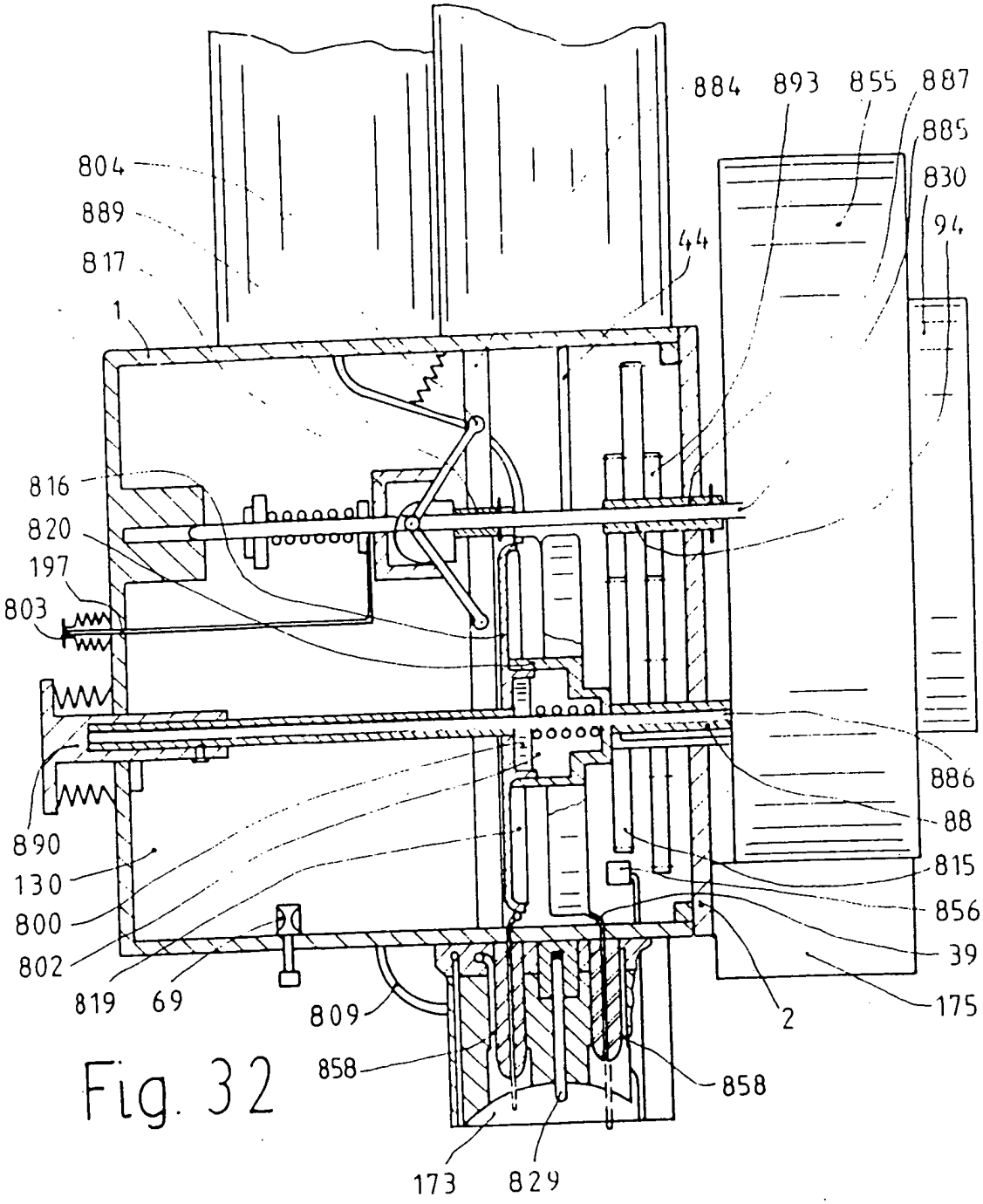

884
893
855
887
885
830
94
804
889
817
1
44
816
820
197
803
886
88
890
130
800
802
815
856
39
819
69
809
2
175
858
858
173
829

Fig. 32

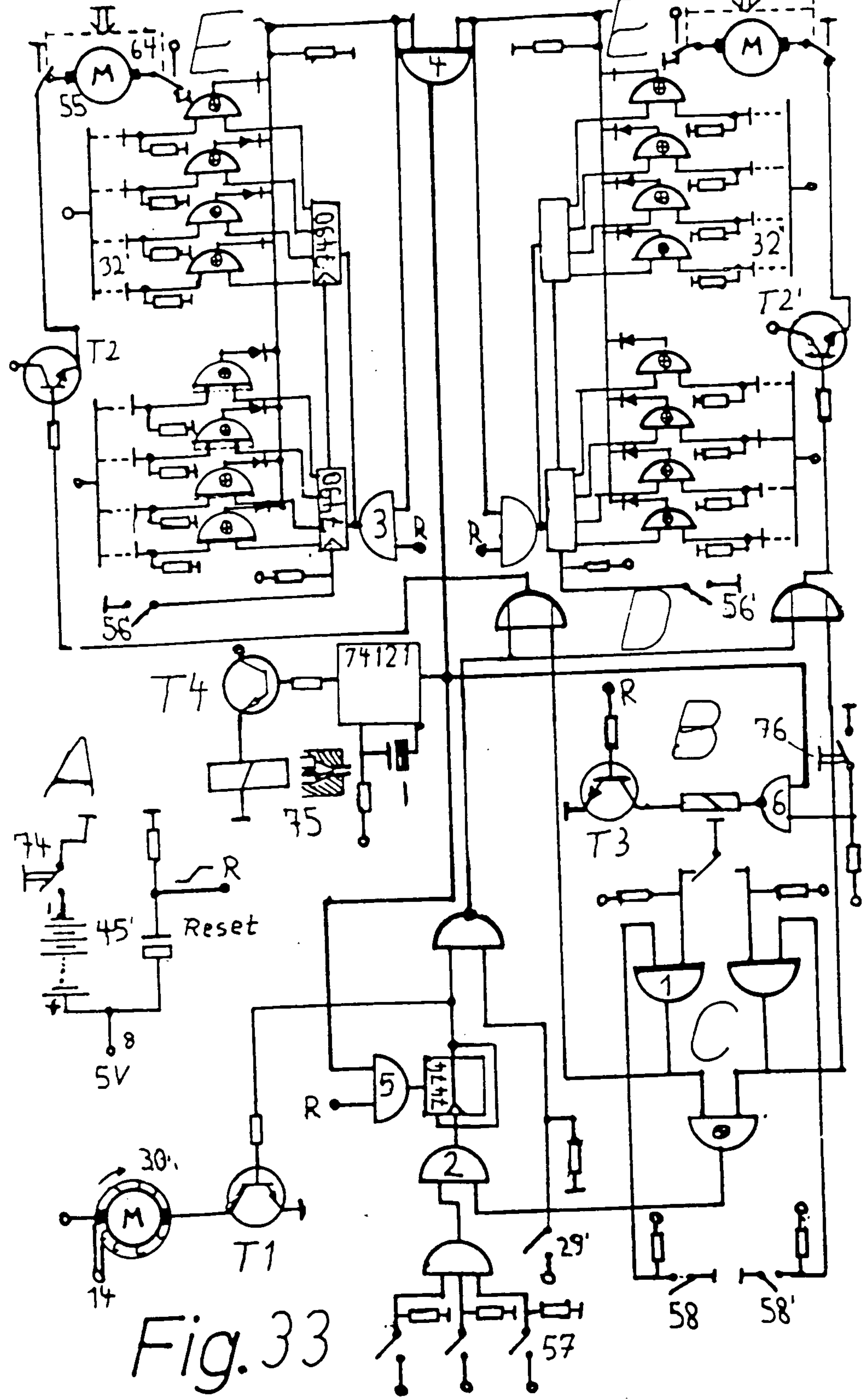

E
E
M
M
64
55
32'
32'
T2
T2'
3
4
R
R
56
56'
D
74121
T4
B
R
76
A
75
1
T3
6
74
R
45'
Reset
1
C
8
5V
5
R
30'
2
M
T1
29'
14
58
58'
57

Fig. 33

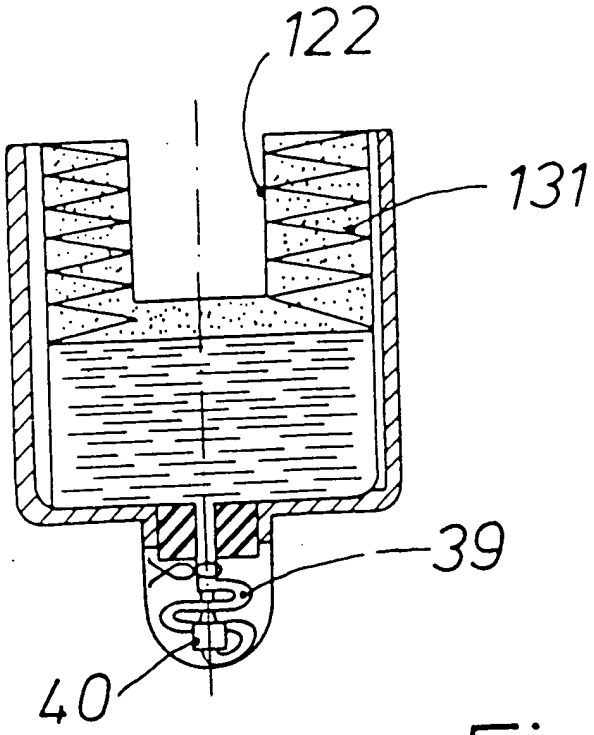


Fig. 34

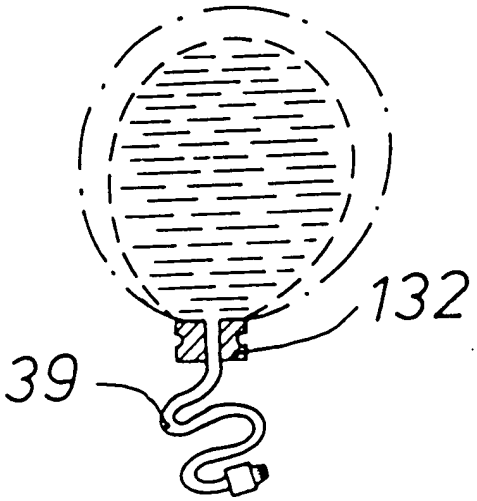


Fig. 35

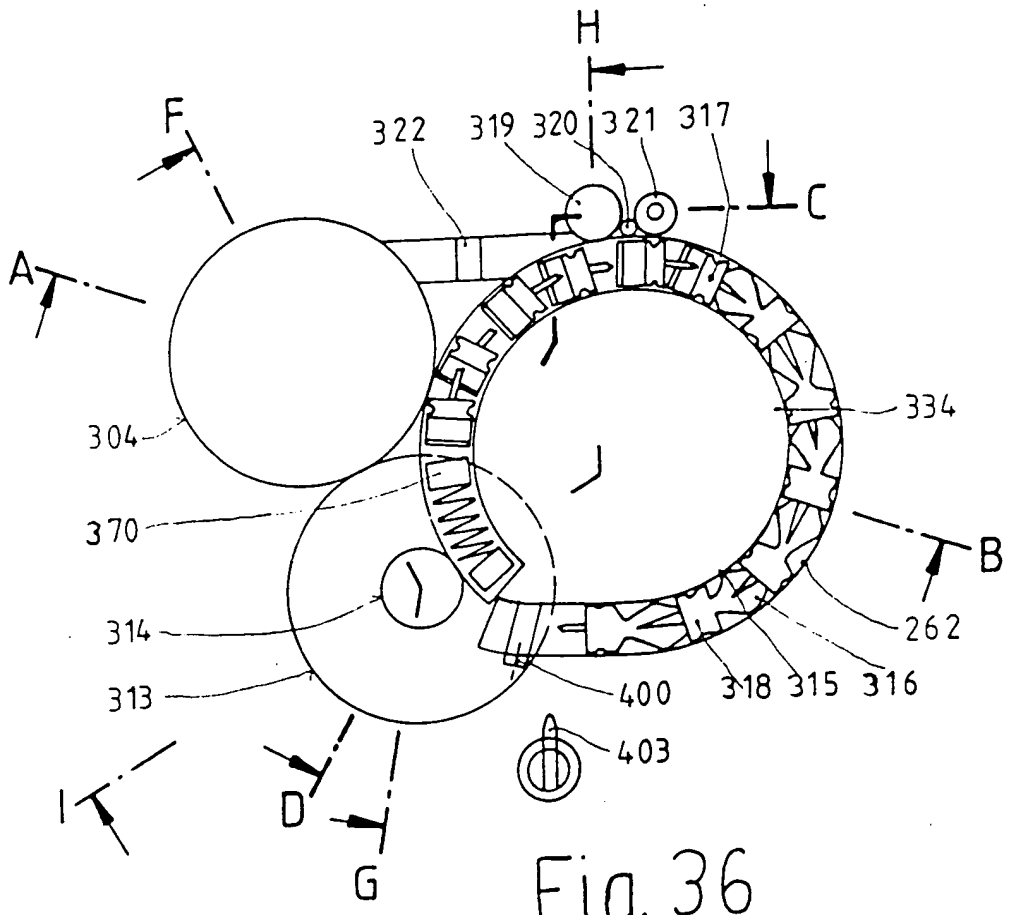

H
F
322
319
320
321
317
C
A
304
334
370
B
314
262
313
400
318
315
316
403
I
D
G

Fig. 36

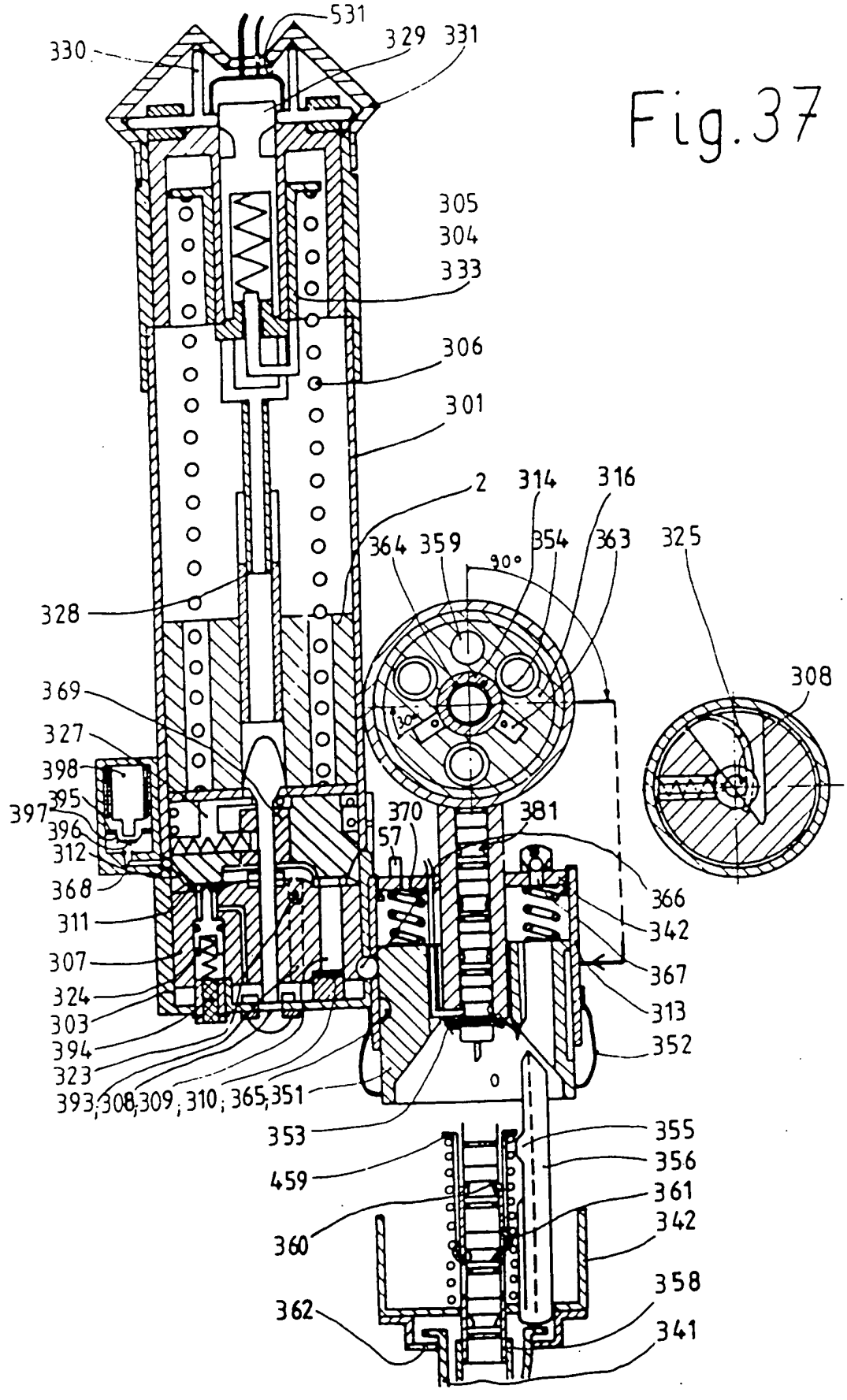

531
330
329
331
305
304
333
306
301
2
314
316
364
359
354
363
325
90°
328
308
369
327
398
395
397
396
312
370
57
381
368
366
311
342
307
367
324
313
303
352
394
323
393
308
309
310
365
351
353
355
459
356
361
360
342
358
362
341

Fig.37

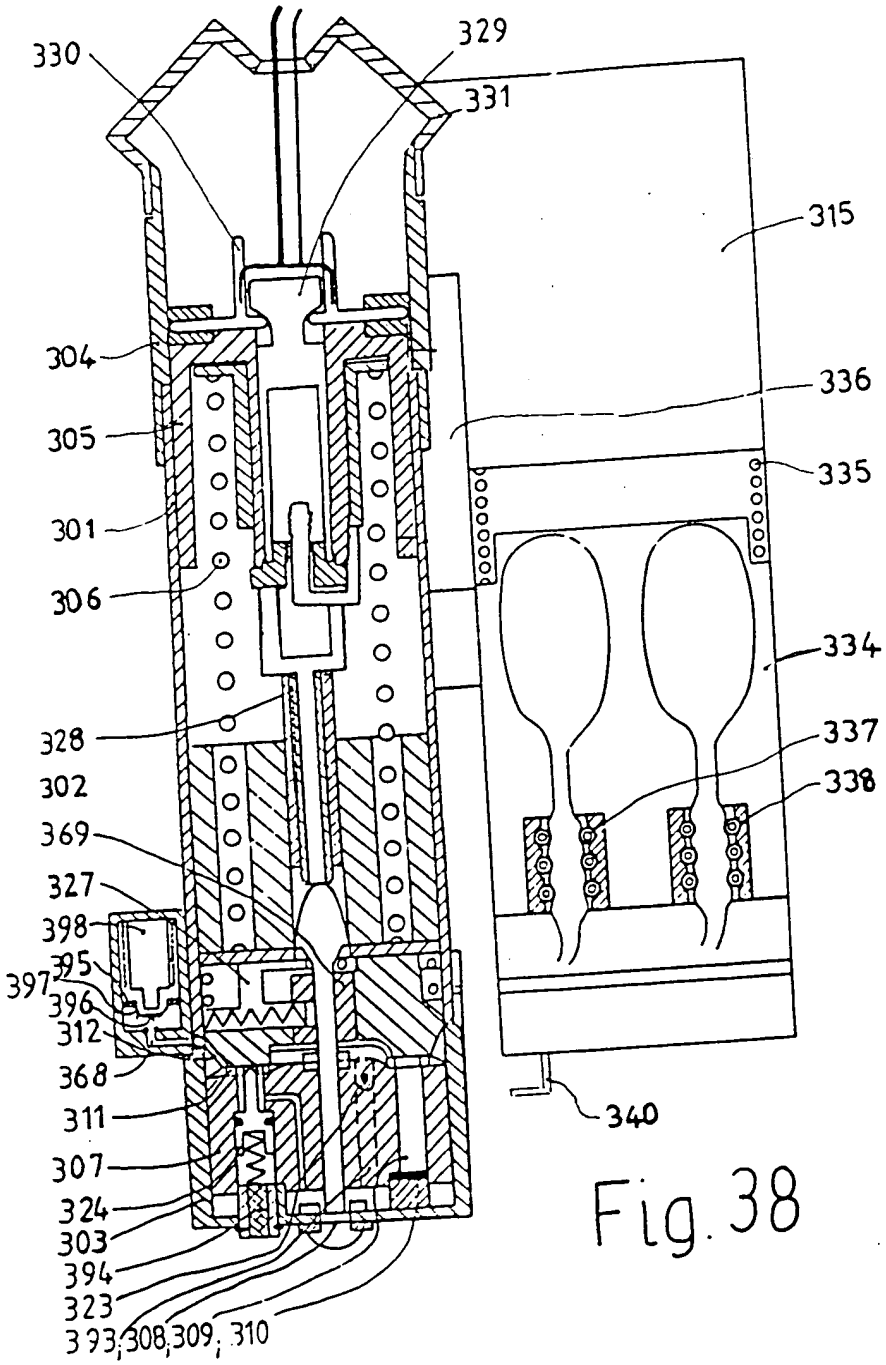
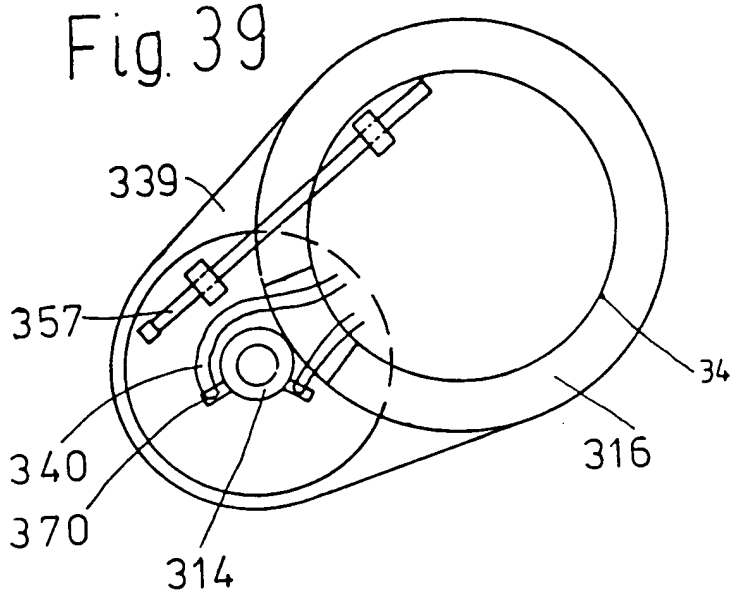

330
329
331
315
304
336
305
335
301
306
334
328
337
302
338
369
327
398
395
397
396
312
368
340
311
307
324
303
394
323
393
308
309
310

Fig. 38

Fig. 39



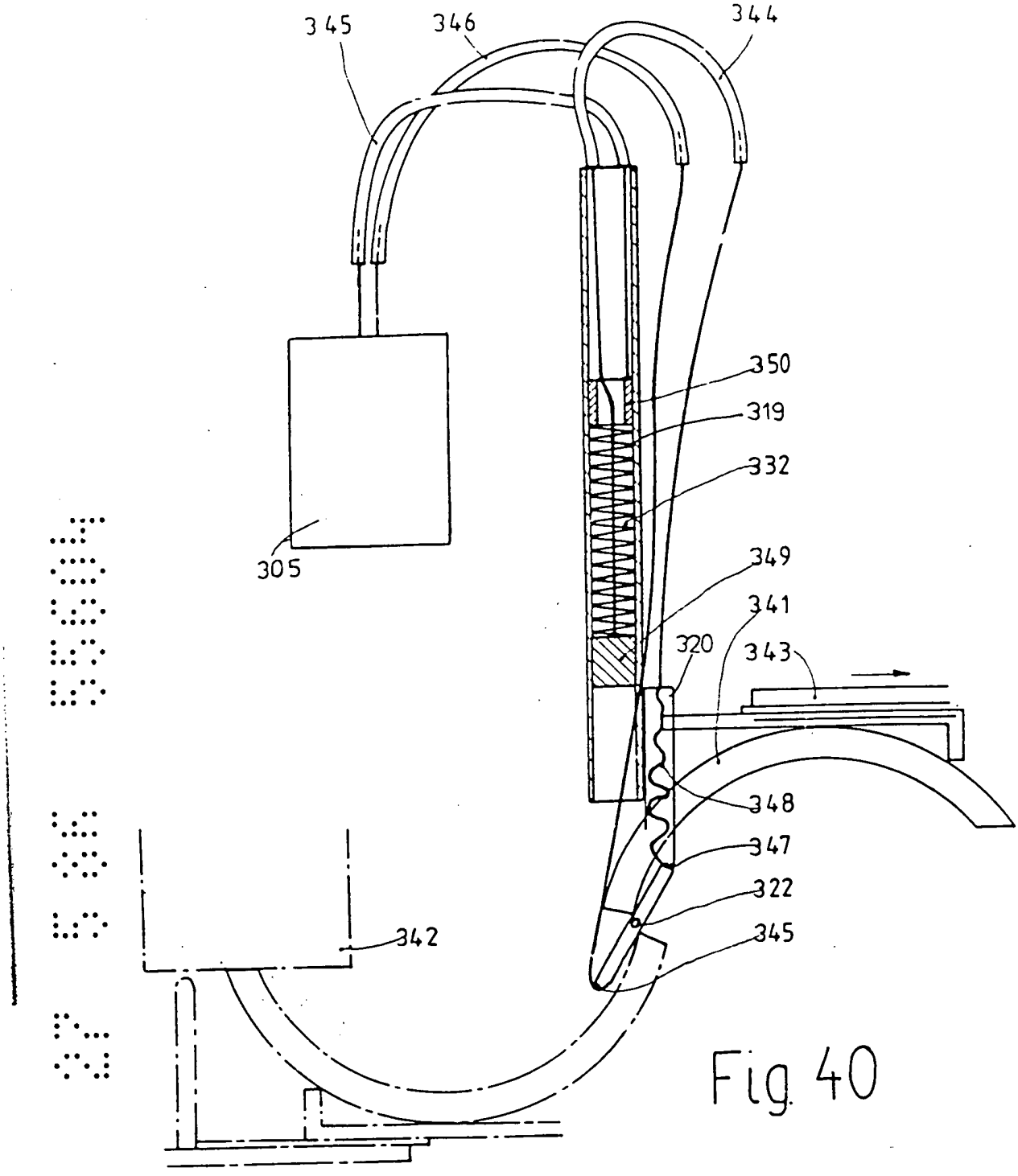


Fig. 40

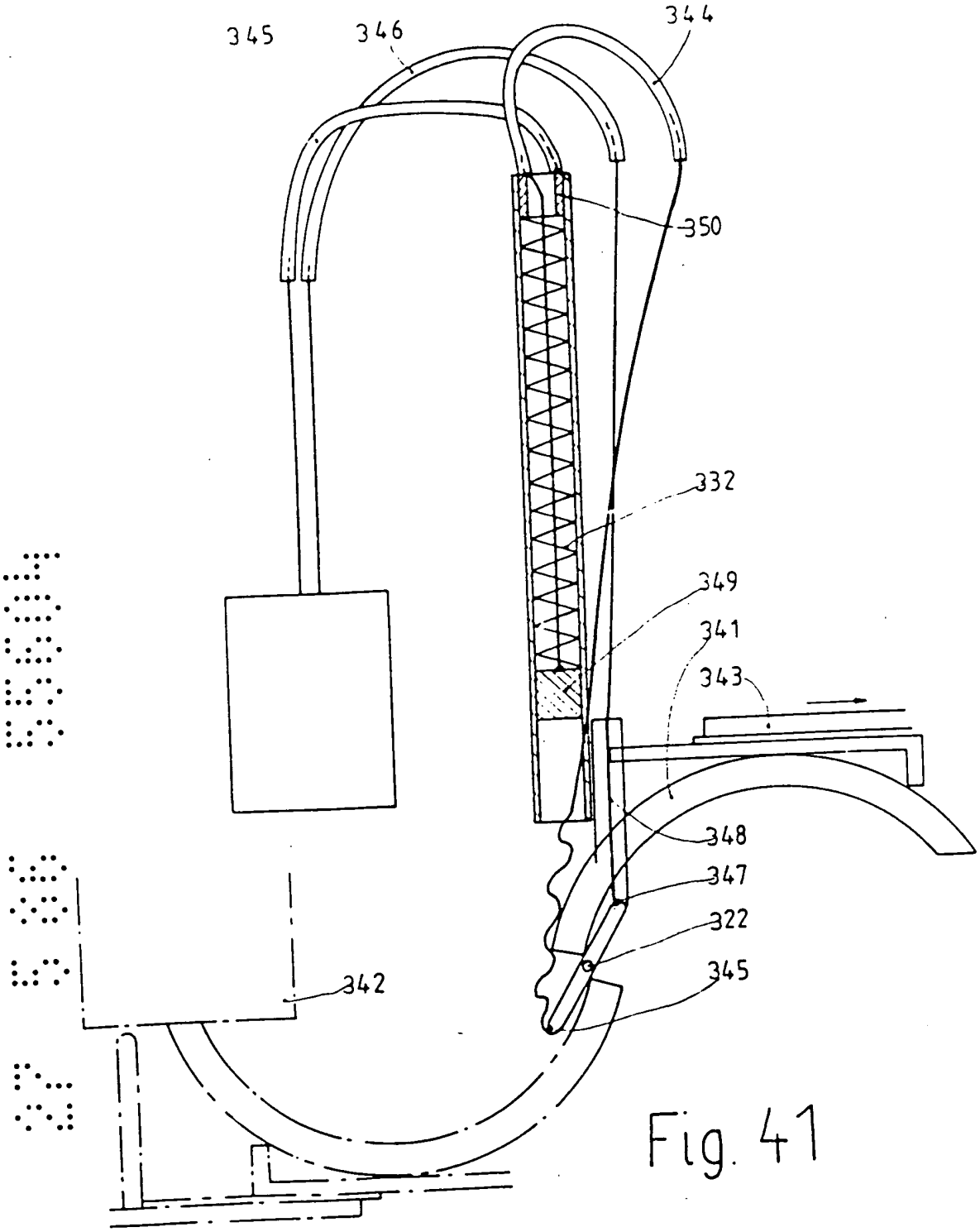


Fig. 41

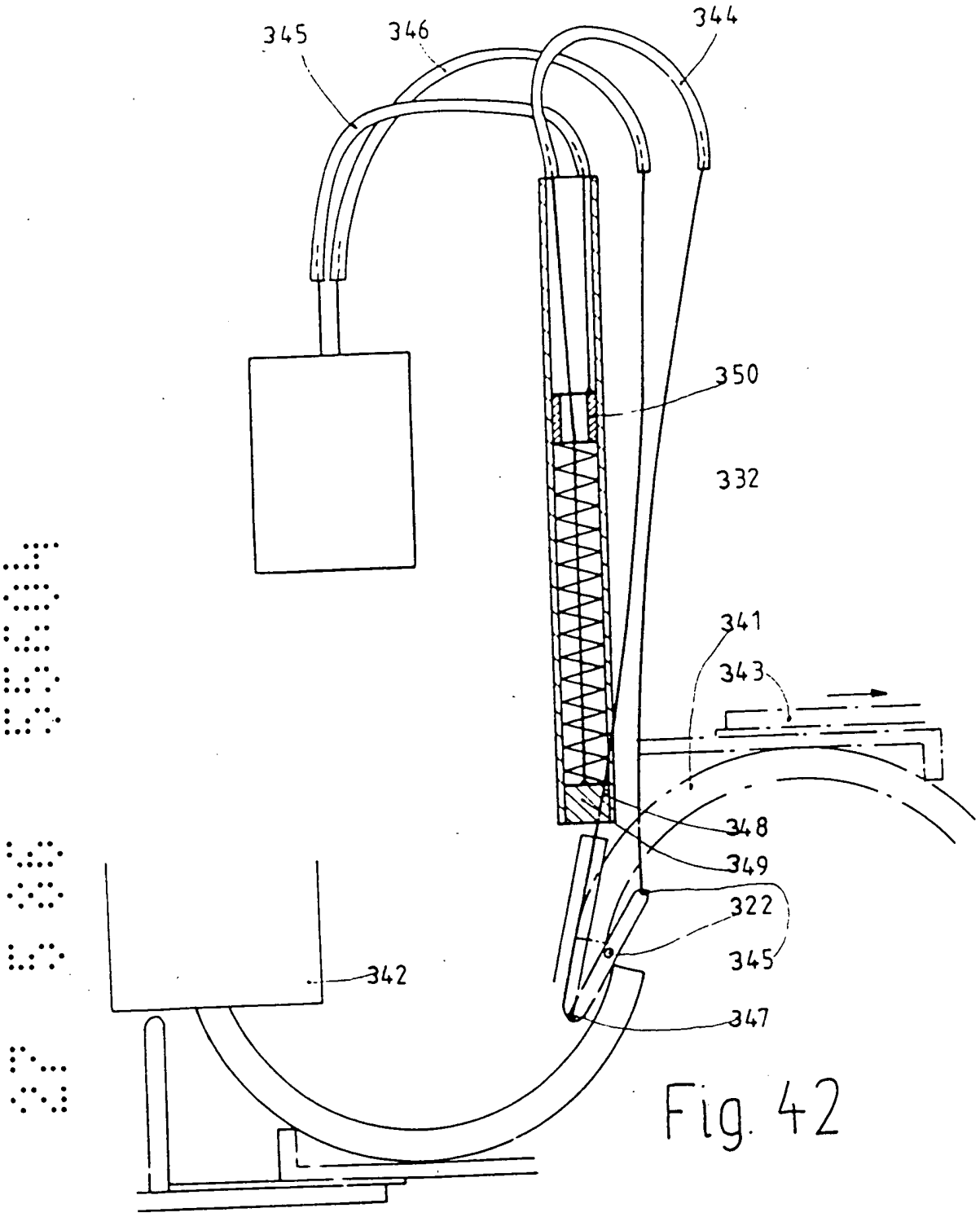


Fig. 42

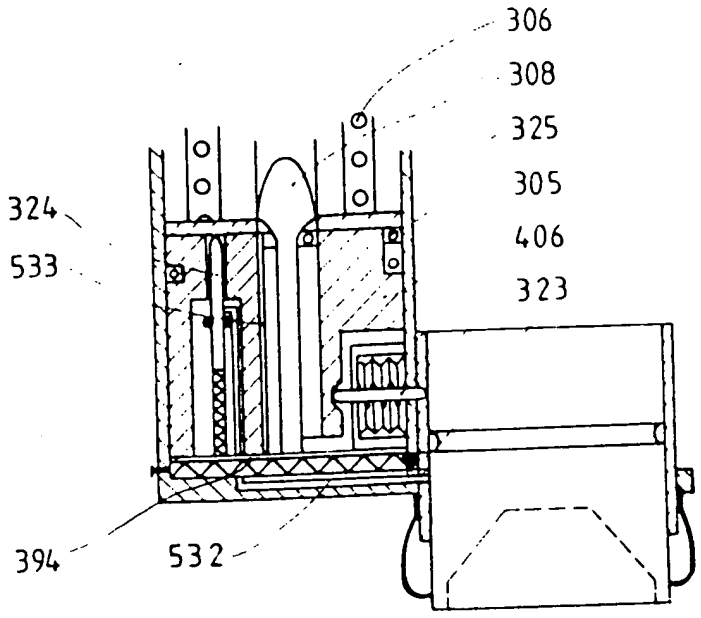


Fig. 43

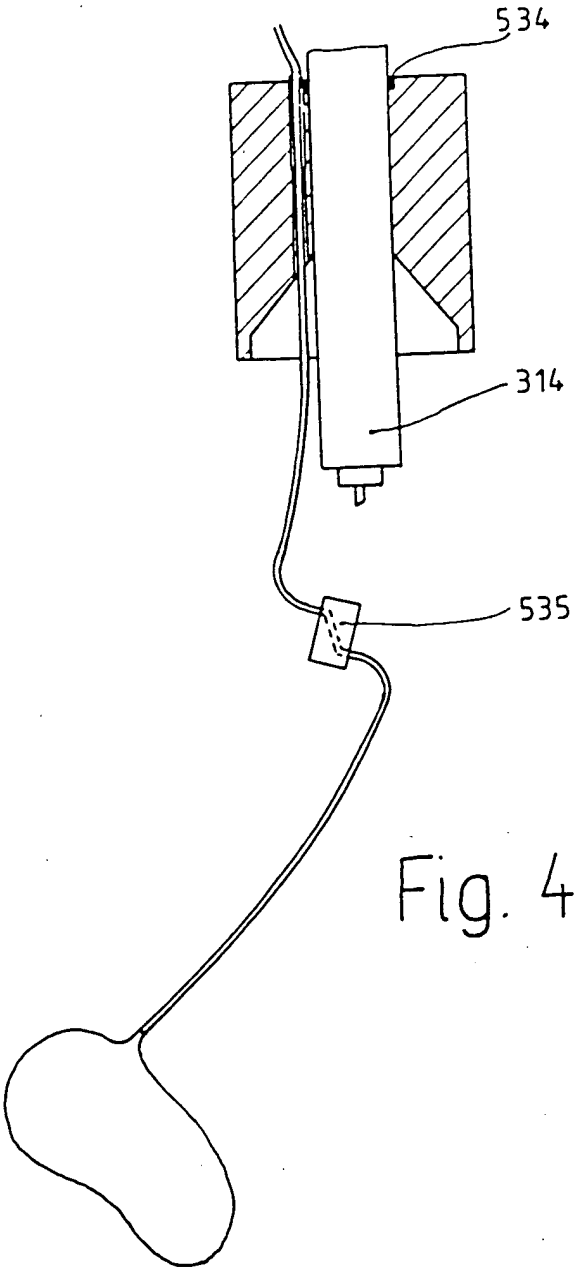
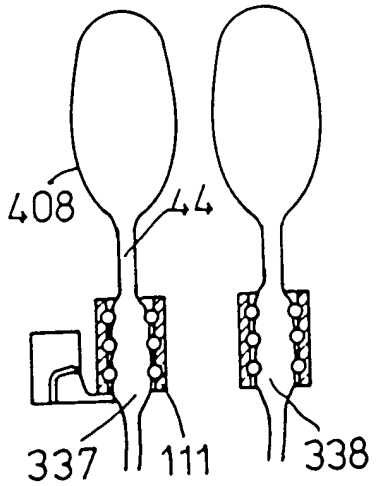


Fig. 44



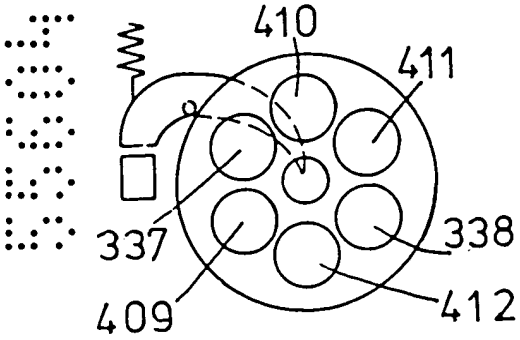


Fig. 45

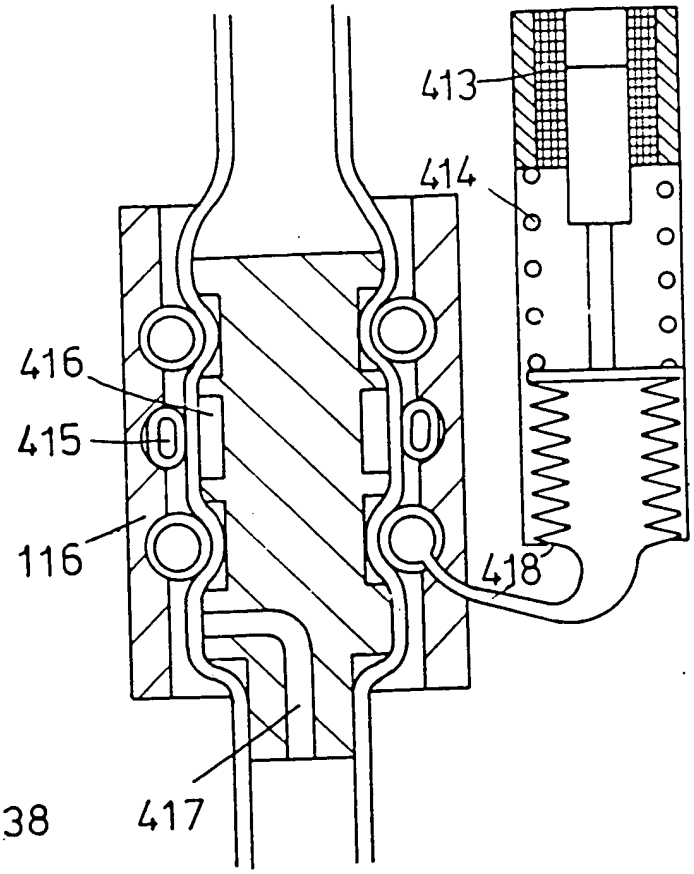


Fig. 46

Fig. 47

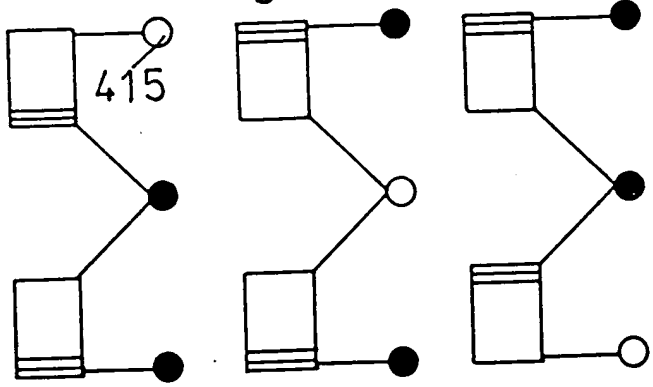


Fig. 48

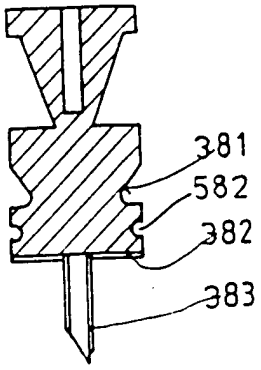
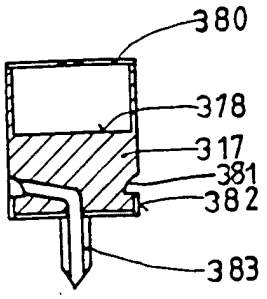


Fig. 49



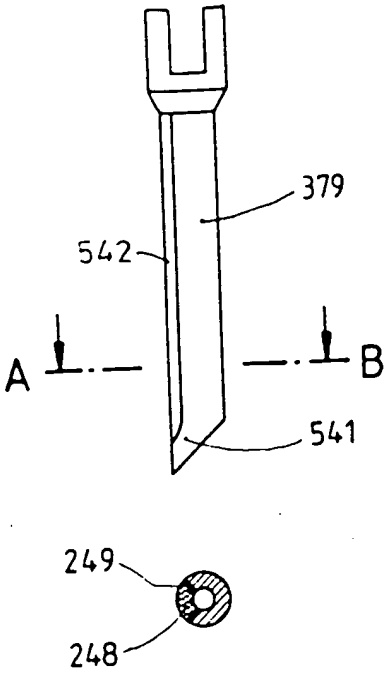


Fig. 50

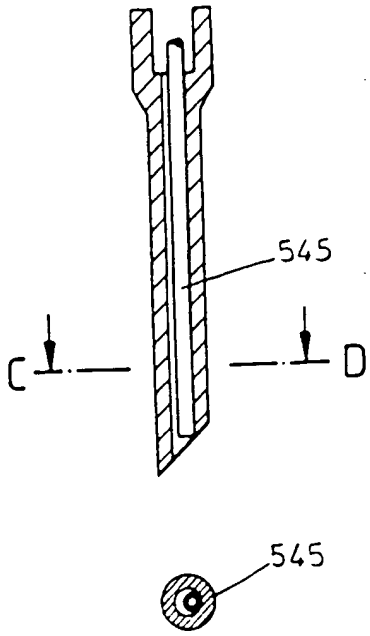


Fig. 51

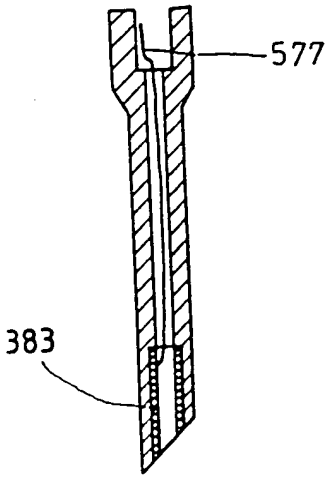


Fig. 52

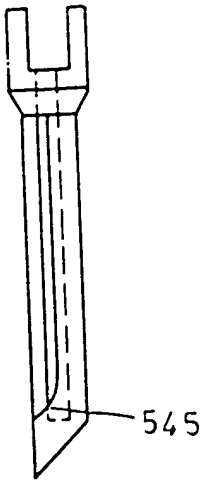


Fig. 53

Fig. 54

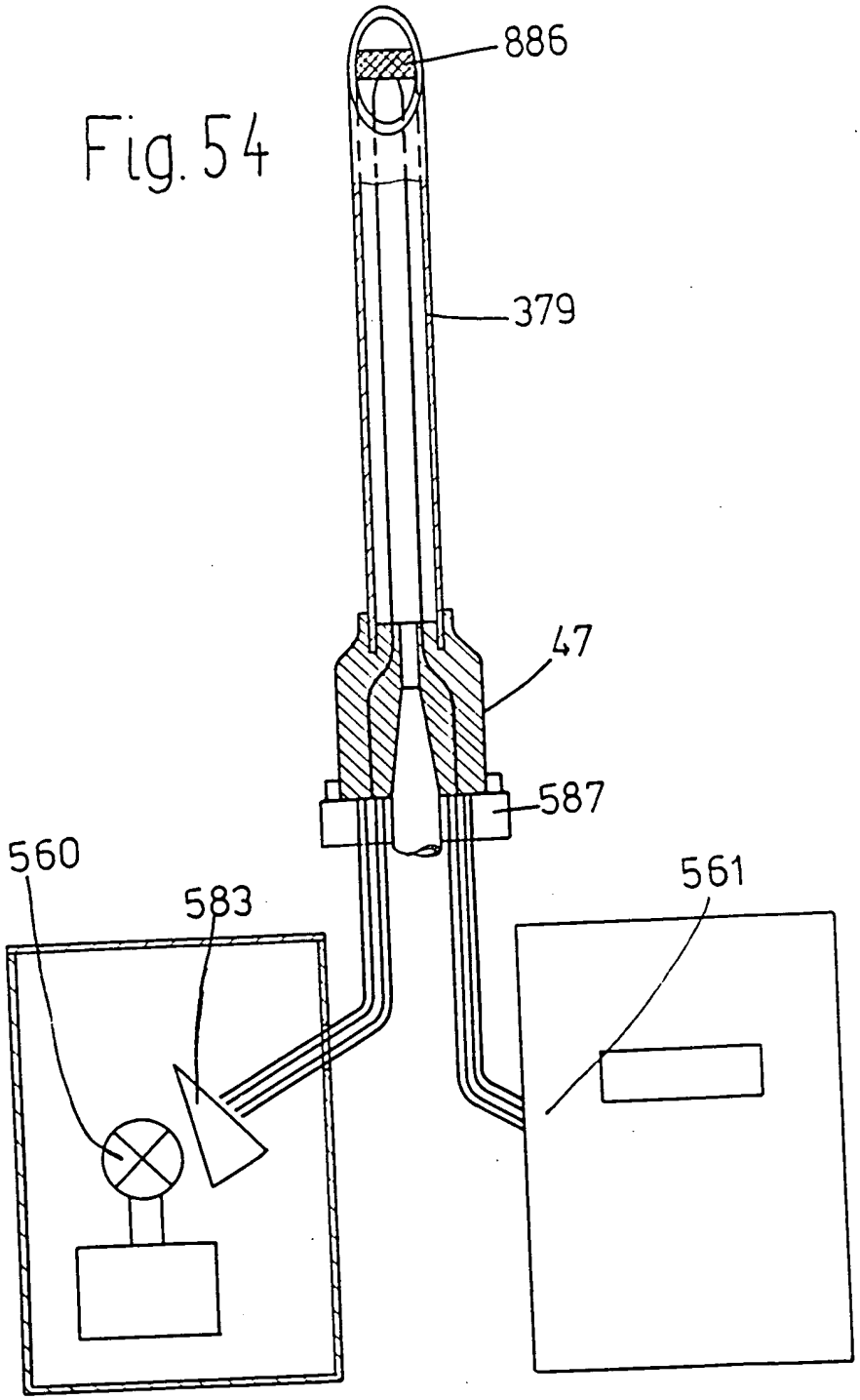


Fig. 55

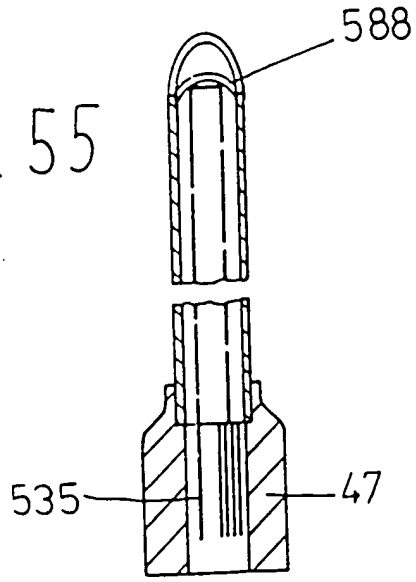
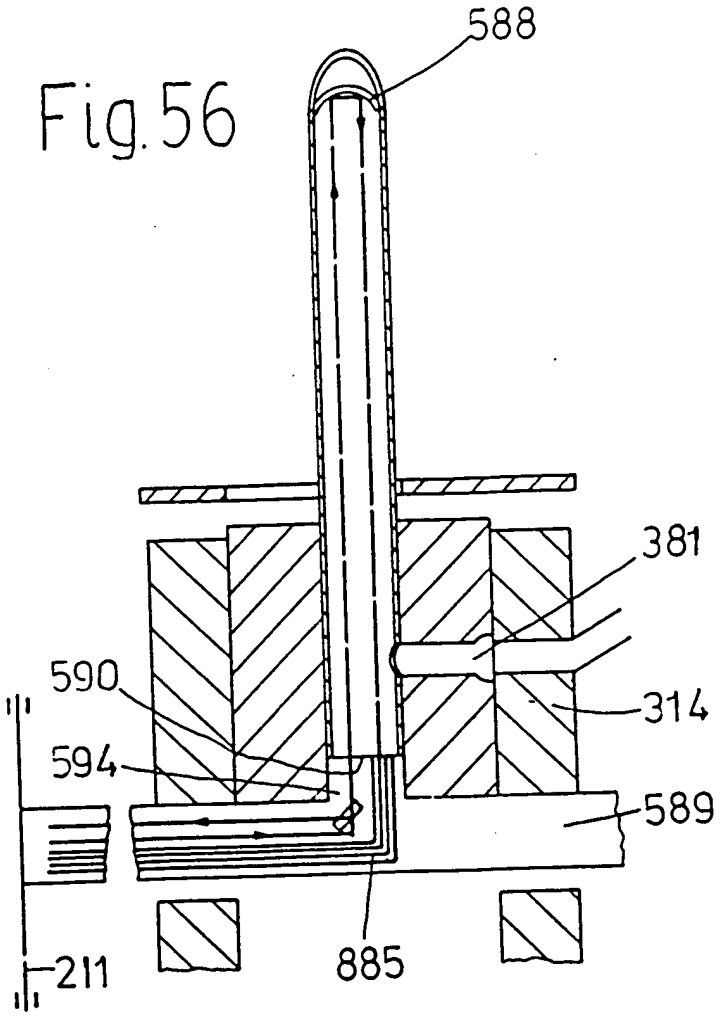


Fig. 56



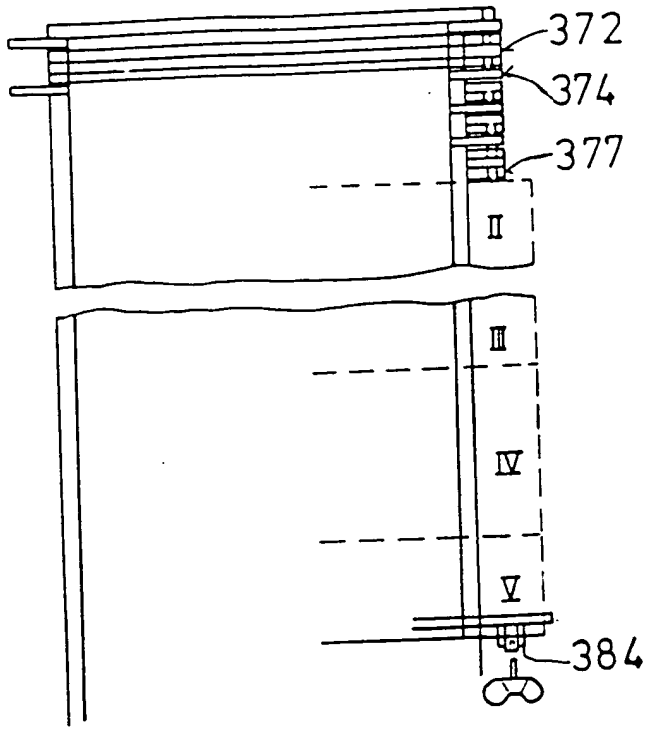
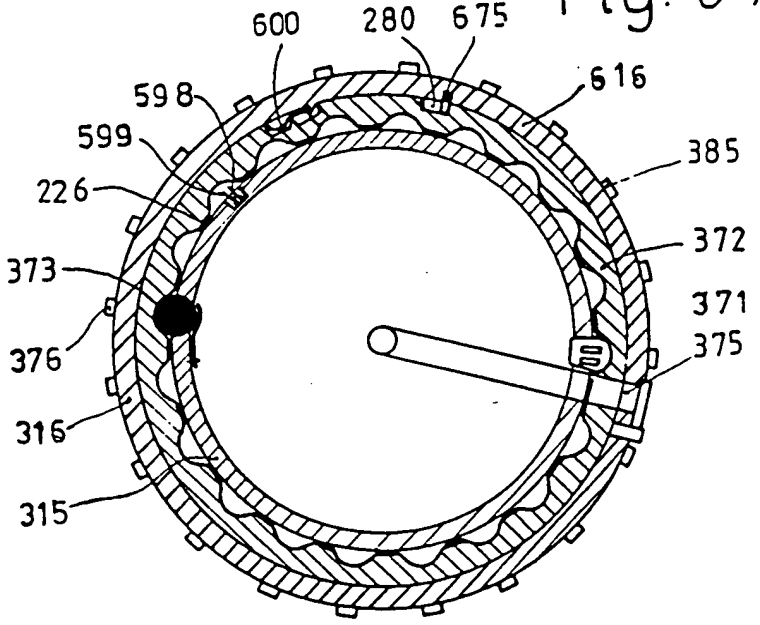

372
374
377
II
III
IV
V
384

Fig. 57


600
280
675
616
598
599
385
226
372
373
371
376
375
316
315

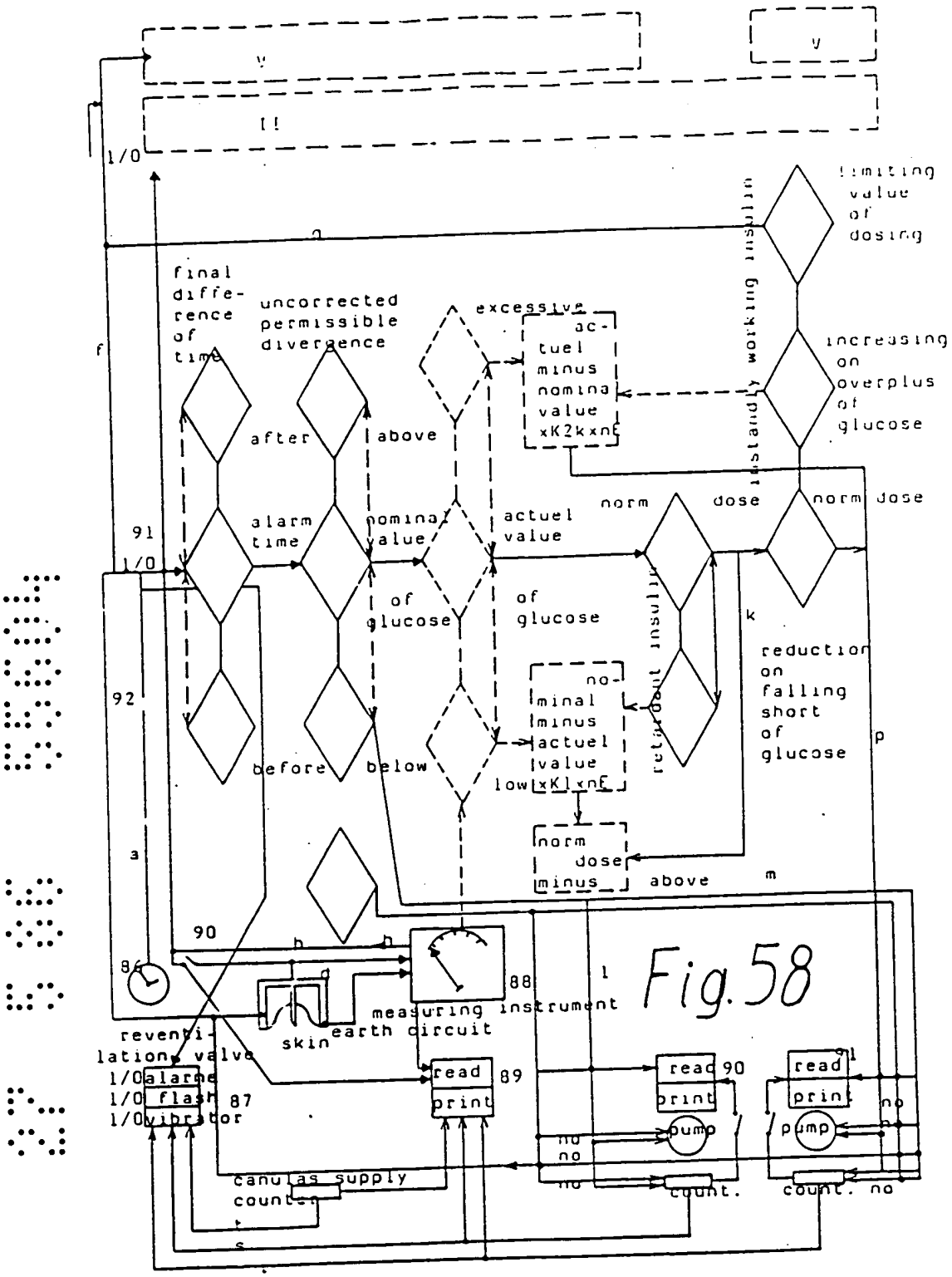
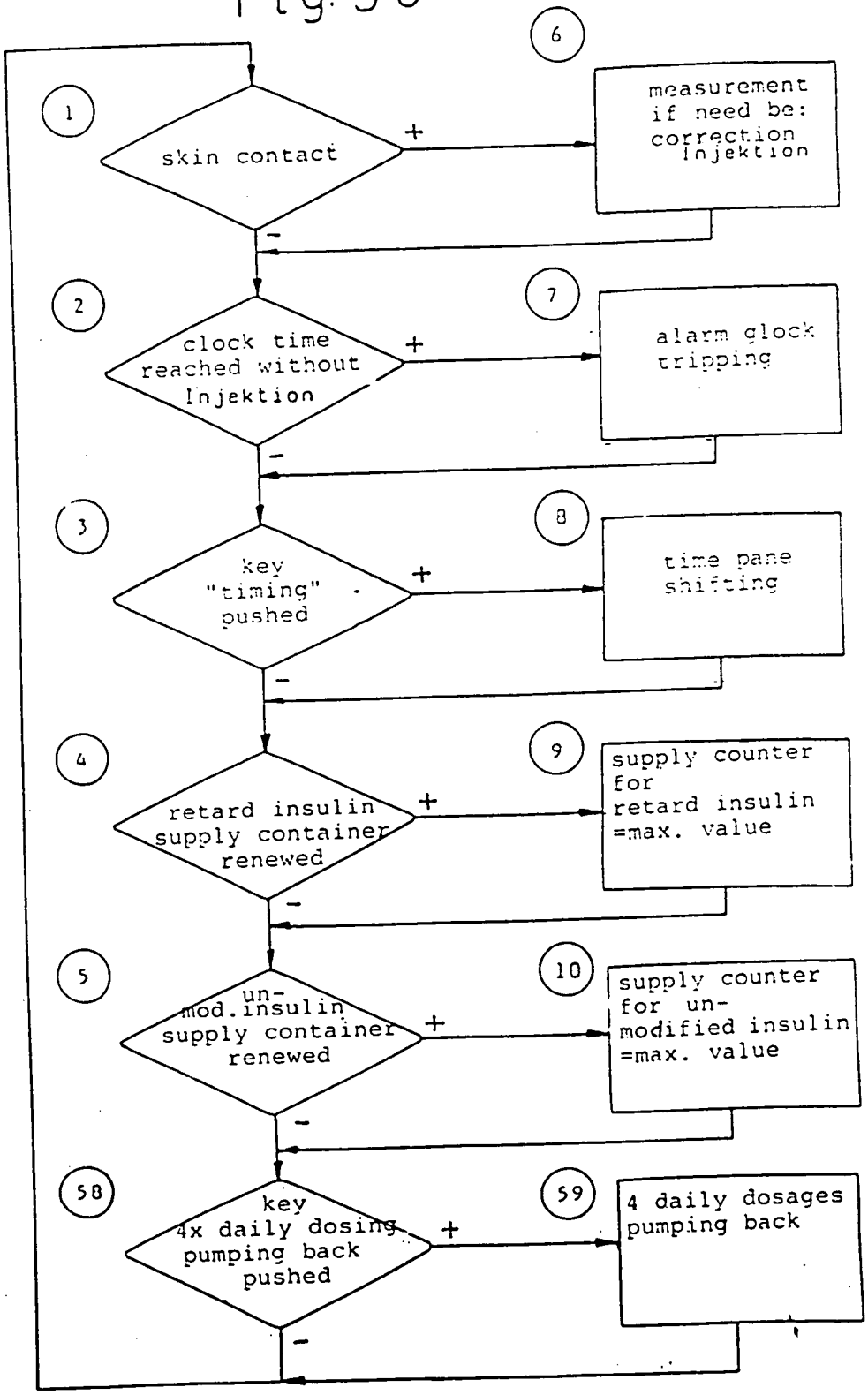

limiting value of dosing
increasing on overplus of glucose
reduction on falling short of glucose
final difference of time
uncorrected permissible divergence
excessive
after
above
before
below
alarm time
nominal value
actuel value
of glucose
norm dose
minus
low
91
92
90
86
88
89
87
measuring instrument
earth circuit
skin
read
print
pump
count.
alarme
flash
vibrator
canulas supply counter
1/0
Fig. 58

Fig. 59


1
skin contact
+
6
measurement if need be: correction injektion
-
2
clock time reached without injektion
+
7
alarm glock tripping
-
3
key "timing" pushed
+
8
time pane shifting
-
4
retard insulin supply container renewed
+
9
supply counter for retard insulin =max. value
-
5
un-mod.insulin supply container renewed
+
10
supply counter for un-modified insulin =max. value
-
58
key 4x daily dosing pumping back pushed
+
59
4 daily dosages pumping back
-

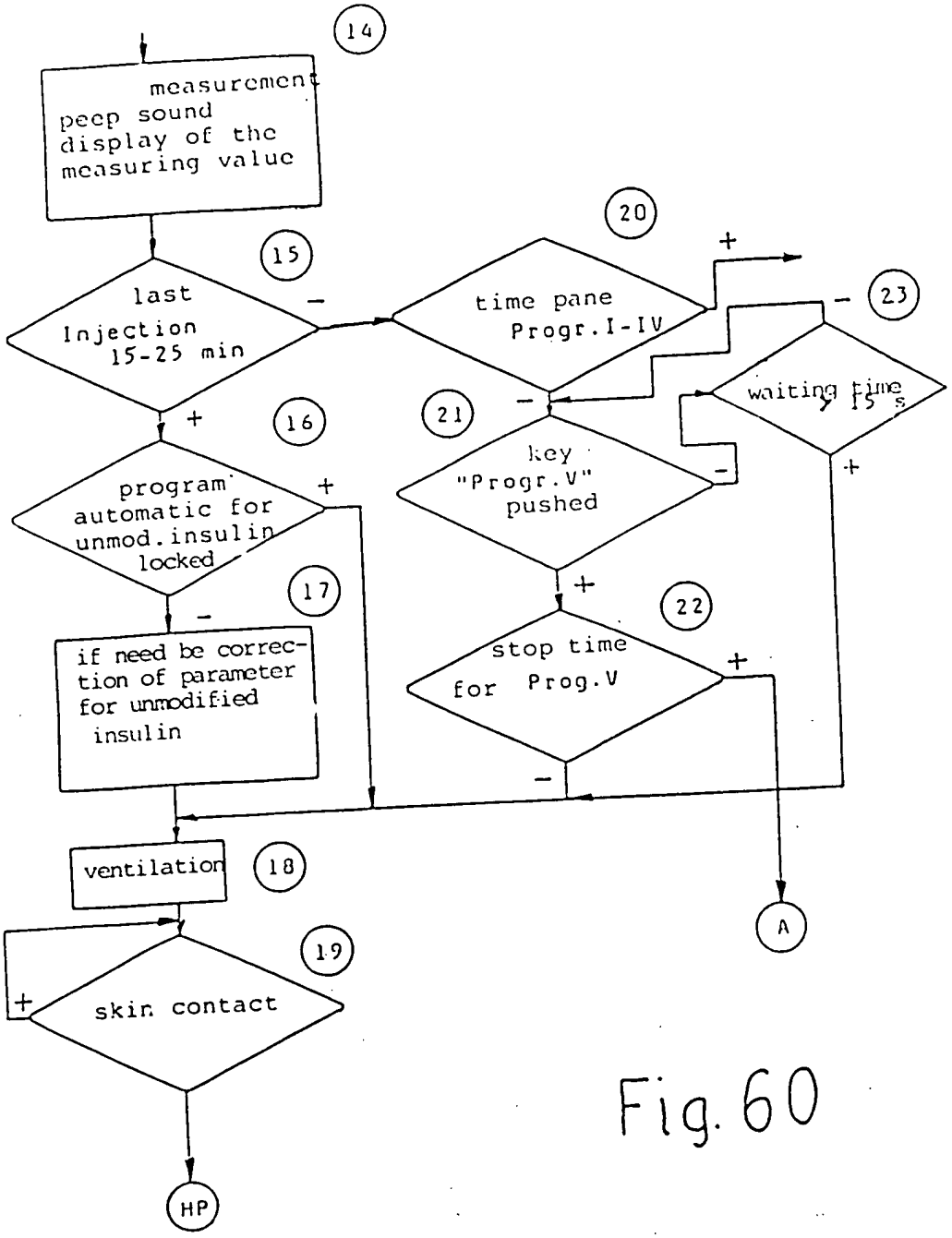

14
measurement
peep sound
display of the
measuring value
15
last
Injection
15-25 min
20
time pane
Progr.I-IV
23
waiting time
> 15 s
16
program
automatic for
unmod.insulin
locked
21
key
"Progr.V"
pushed
17
if need be correc-
tion of parameter
for unmodified
insulin
22
stop time
for Prog.V
ventilation
18
A
19
skin contact
HP

Fig. 60

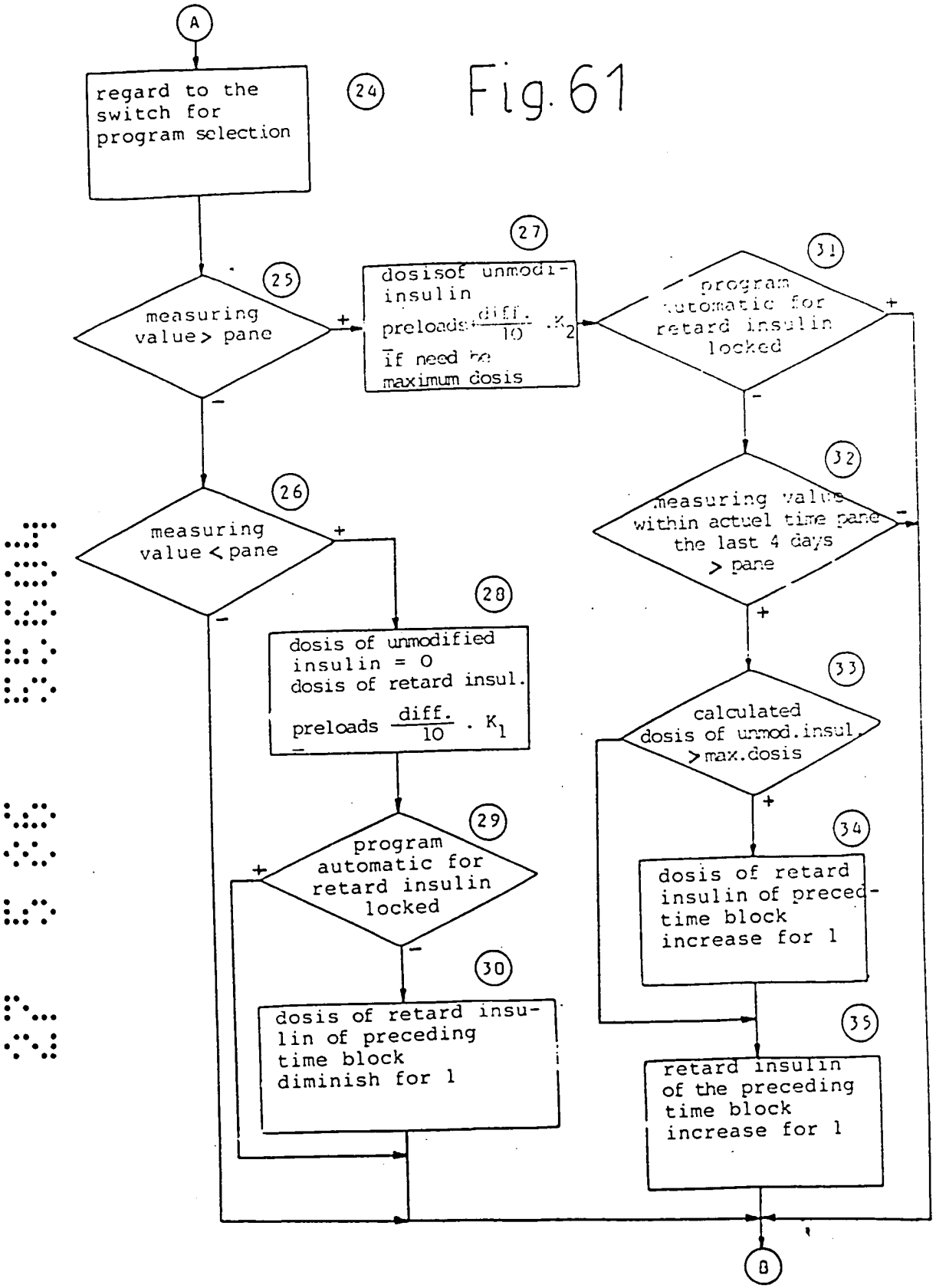

A
regard to the switch for program selection
24
25
measuring value > pane
+
-
27
dosisof unmodi- insulin
preloads diff. / 10 . K2
if need be maximum dosis
31
program automatic for retard insulin locked
+
-
26
measuring value < pane
+
-
28
dosis of unmodified insulin = 0
dosis of retard insul.
preloads diff. / 10 . K1
29
program automatic for retard insulin locked
+
-
30
dosis of retard insulin of preceding time block diminish for 1
32
measuring value within actuel time pane the last 4 days > pane
+
-
33
calculated dosis of unmod.insul. > max.dosis
+
34
dosis of retard insulin of preced- time block increase for 1
35
retard insulin of the preceding time block increase for 1
B

Fig. 61

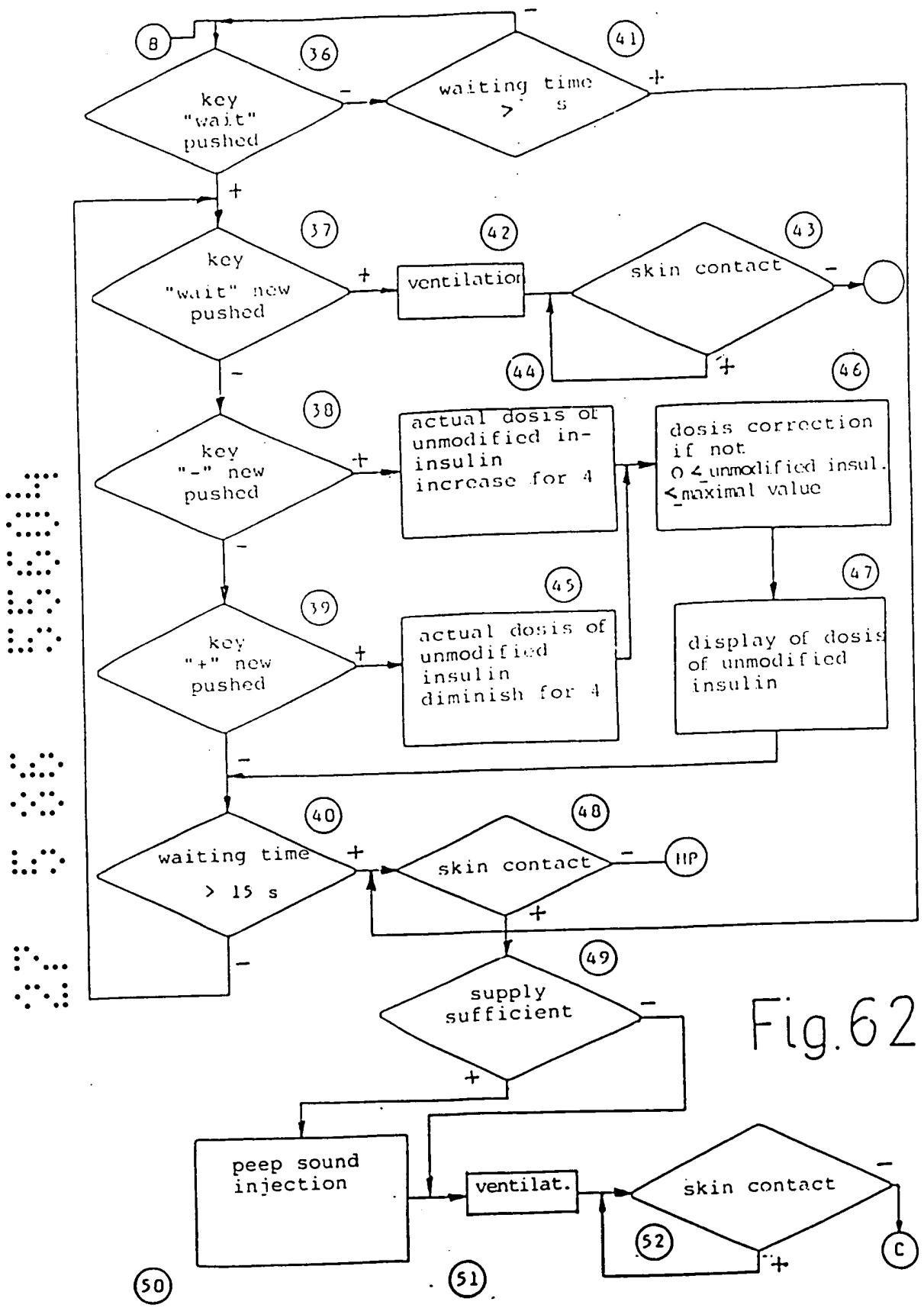

8
36
key "wait" pushed
41
waiting time > s
37
key "wait" new pushed
42
ventilation
43
skin contact
44
46
38
key "-" new pushed
actual dosis of unmodified insulin increase for 4
dosis correction if not 0 ≤ unmodified insul. ≤ maximal value
39
key "+" new pushed
45
actual dosis of unmodified insulin diminish for 4
47
display of dosis of unmodified insulin
40
waiting time > 15 s
48
skin contact
HP
49
supply sufficient
peep sound injection
ventilat.
skin contact
52
C
50
51

Fig.62

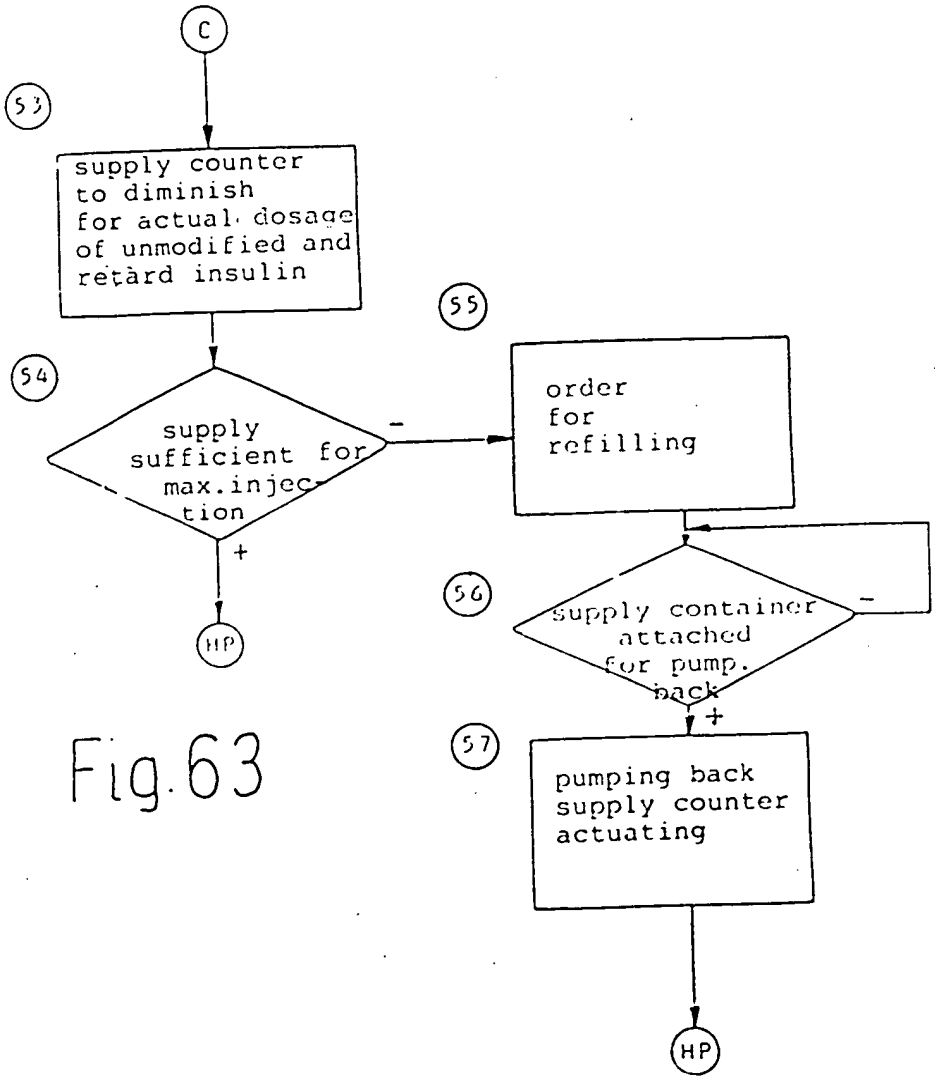

C
53
supply counter to diminish for actual dosage of unmodified and retard insulin
54
supply sufficient for max.injection
-
+
55
order for refilling
56
supply container attached for pump. back
-
+
57
pumping back supply counter actuating
HP
HP

Fig.63

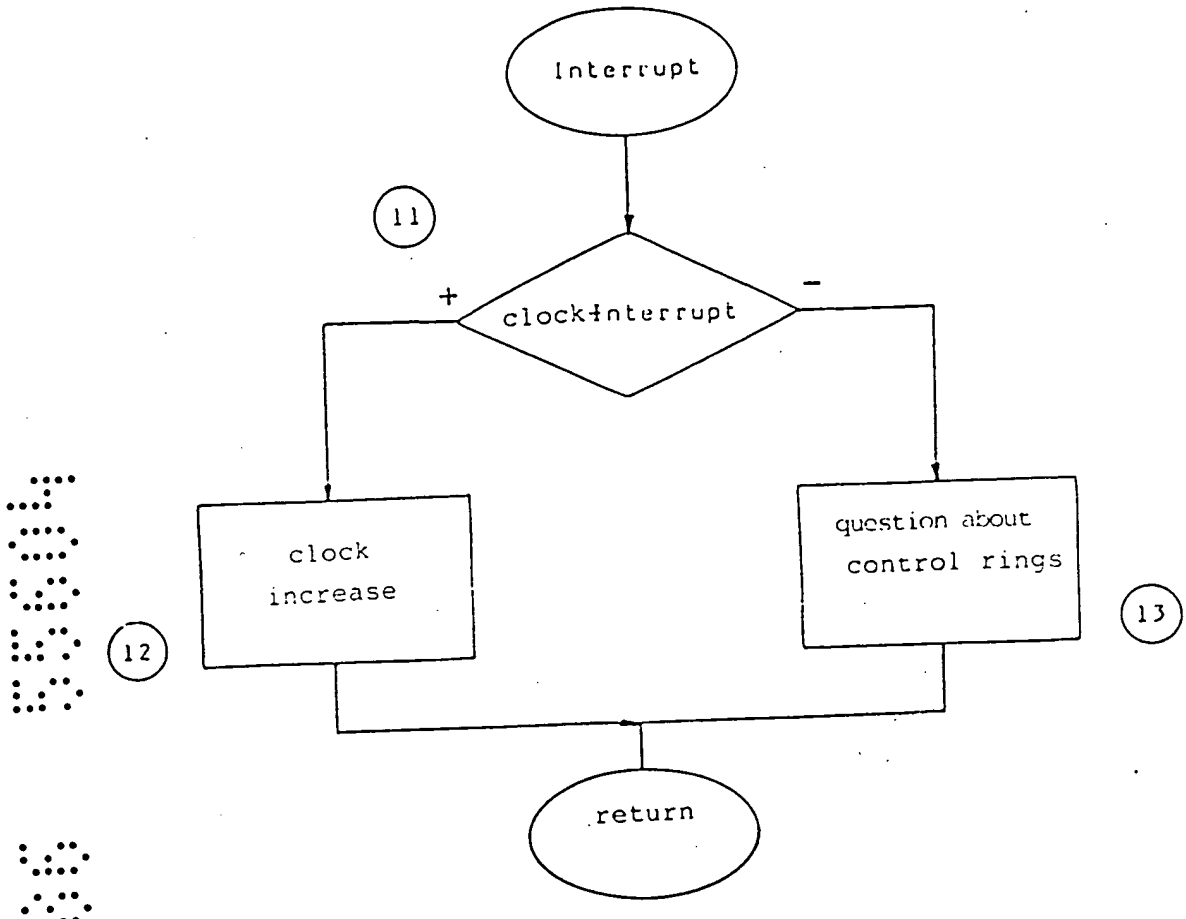

Interrupt
11
+
clock interrupt
-
clock
increase
question about
control rings
12
13
return

Fig. 64

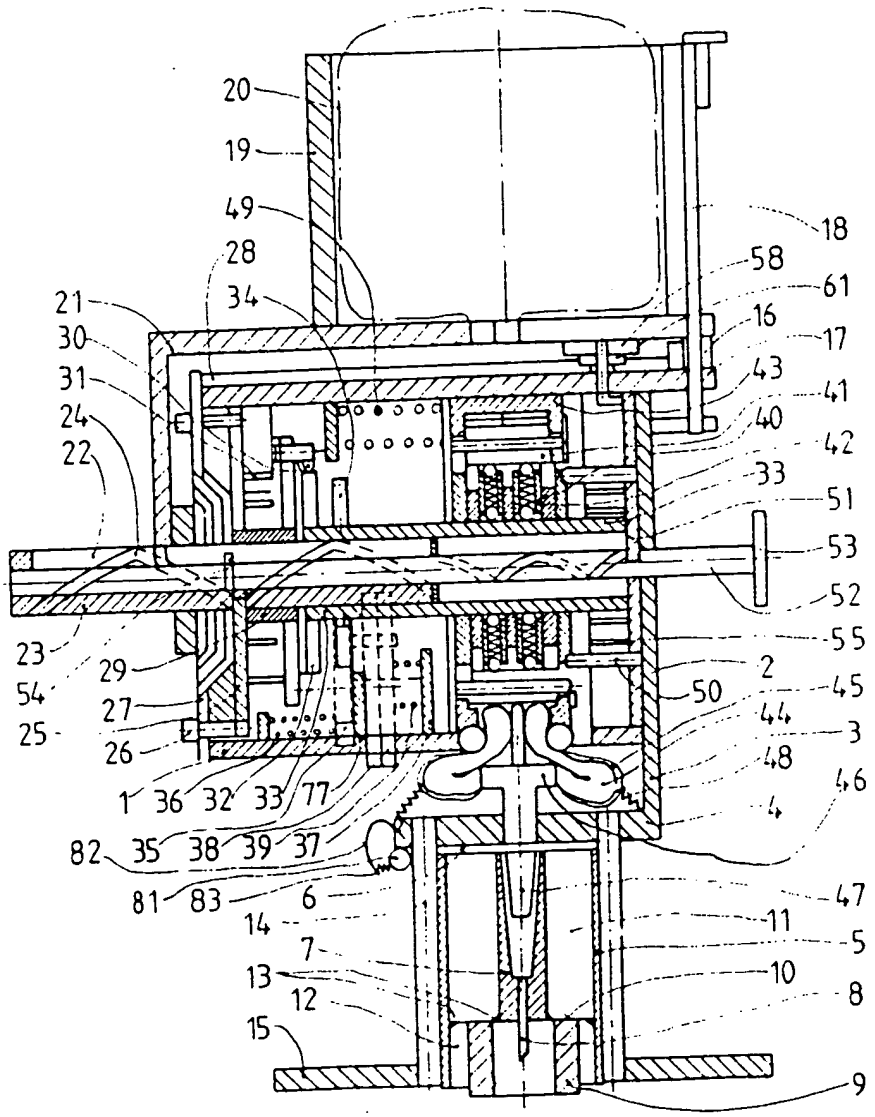

20
19
49
28
34
21
30
31
24
22
18
58
61
16
17
43
41
40
42
33
51
53
52
55
2
45
50
44
3
48
46
4
23
29
54
27
25
26
1
36
32
33
77
82
35
38
39
37
81
83
6
14
7
13
12
15
47
11
5
10
8
9

Fig.65

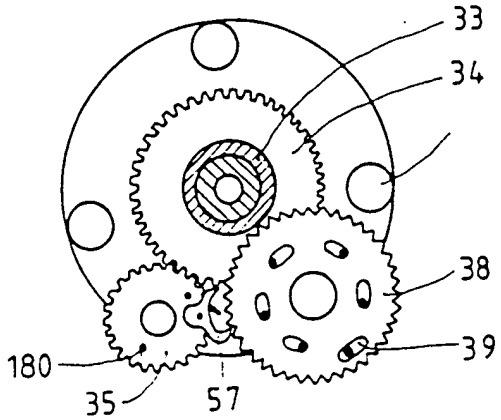


Fig. 67

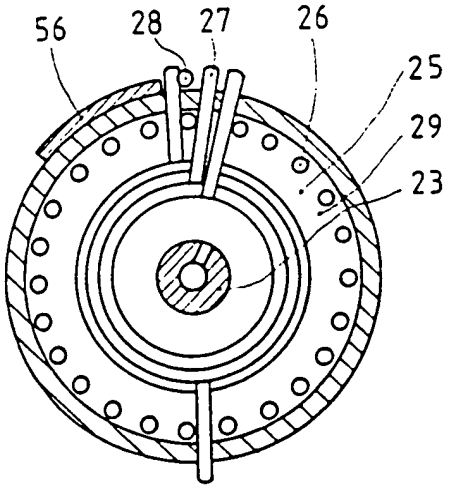


Fig. 66

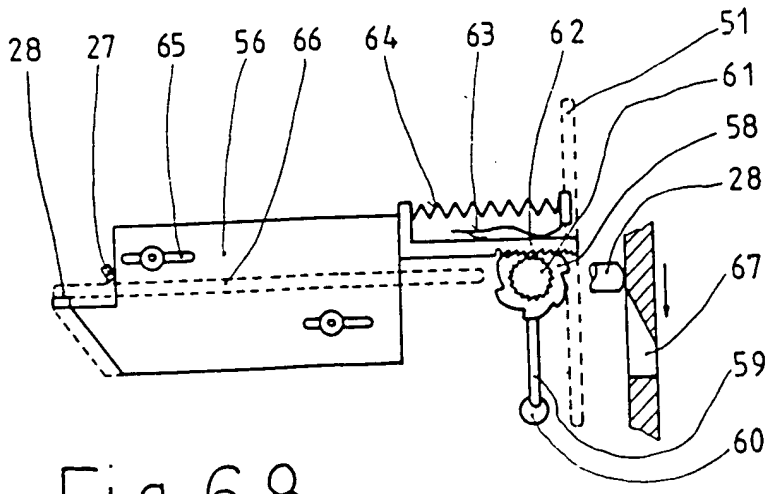


Fig. 68

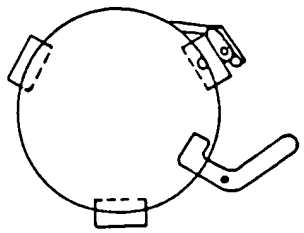


Fig. 69

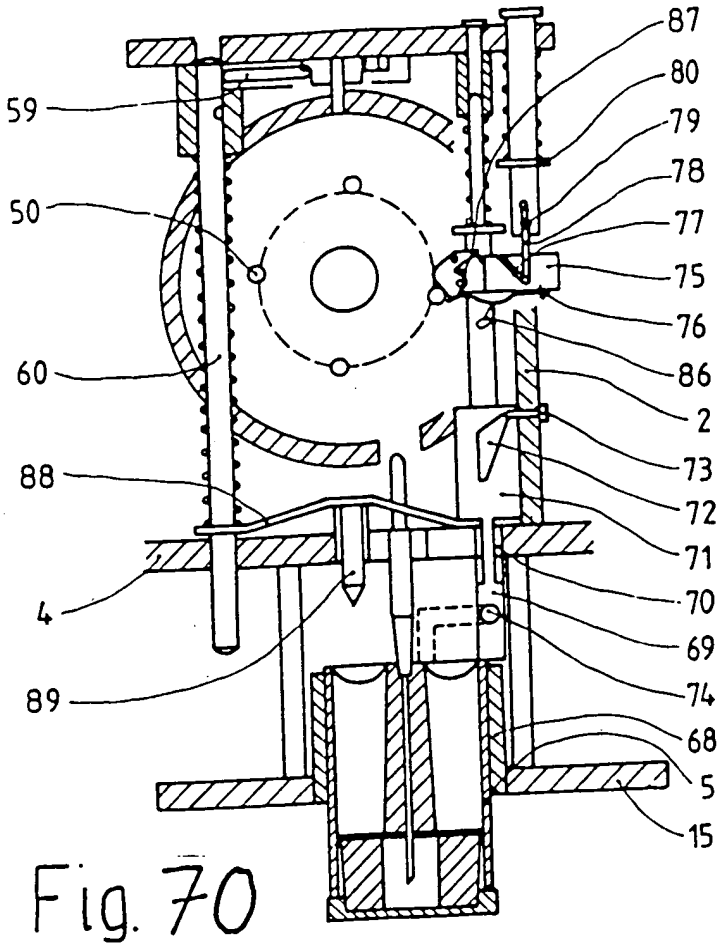

87
80
79
78
77
75
76
86
2
73
72
71
70
69
74
68
5
15
59
50
60
88
4
89

Fig. 70

Fig. 71

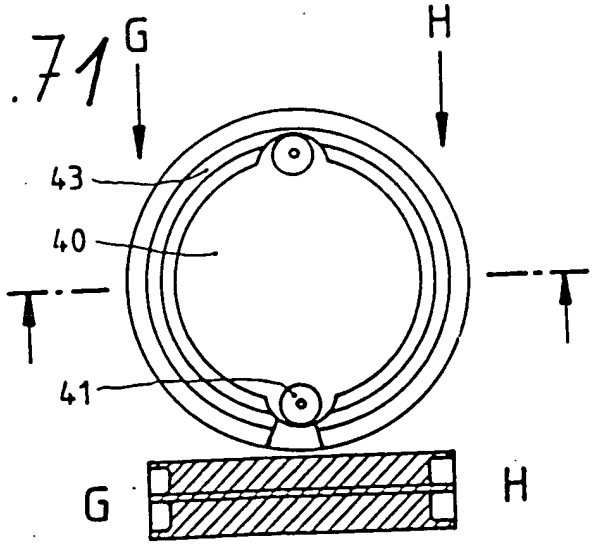

G
H
43
40
41
G
H

Fig. 73

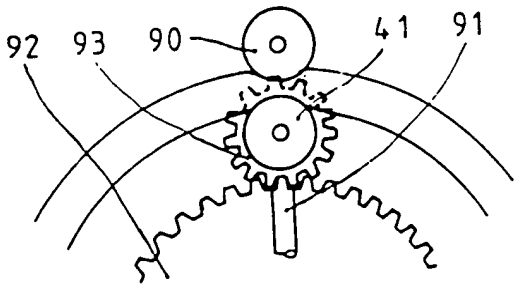
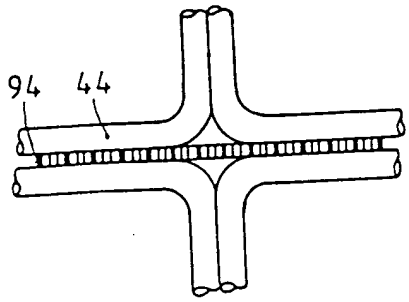


Fig. 74



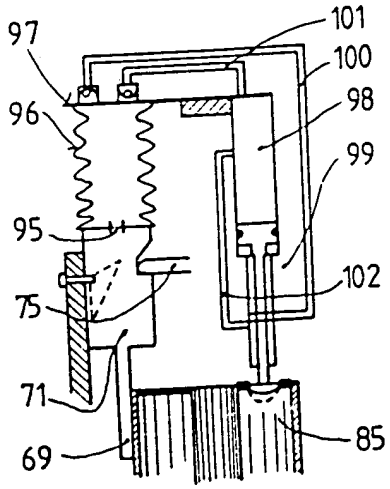


Fig. 75

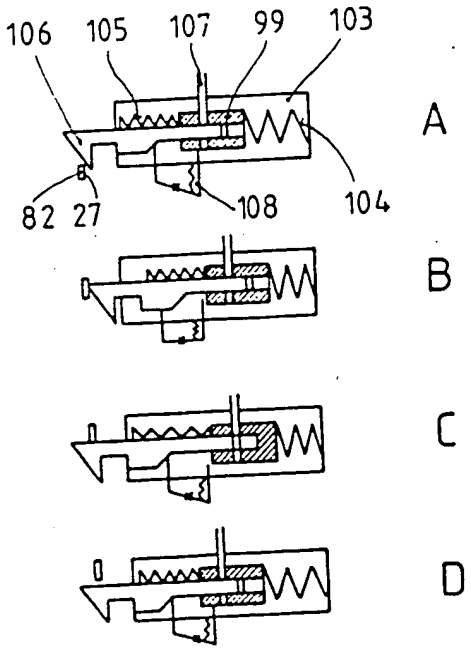
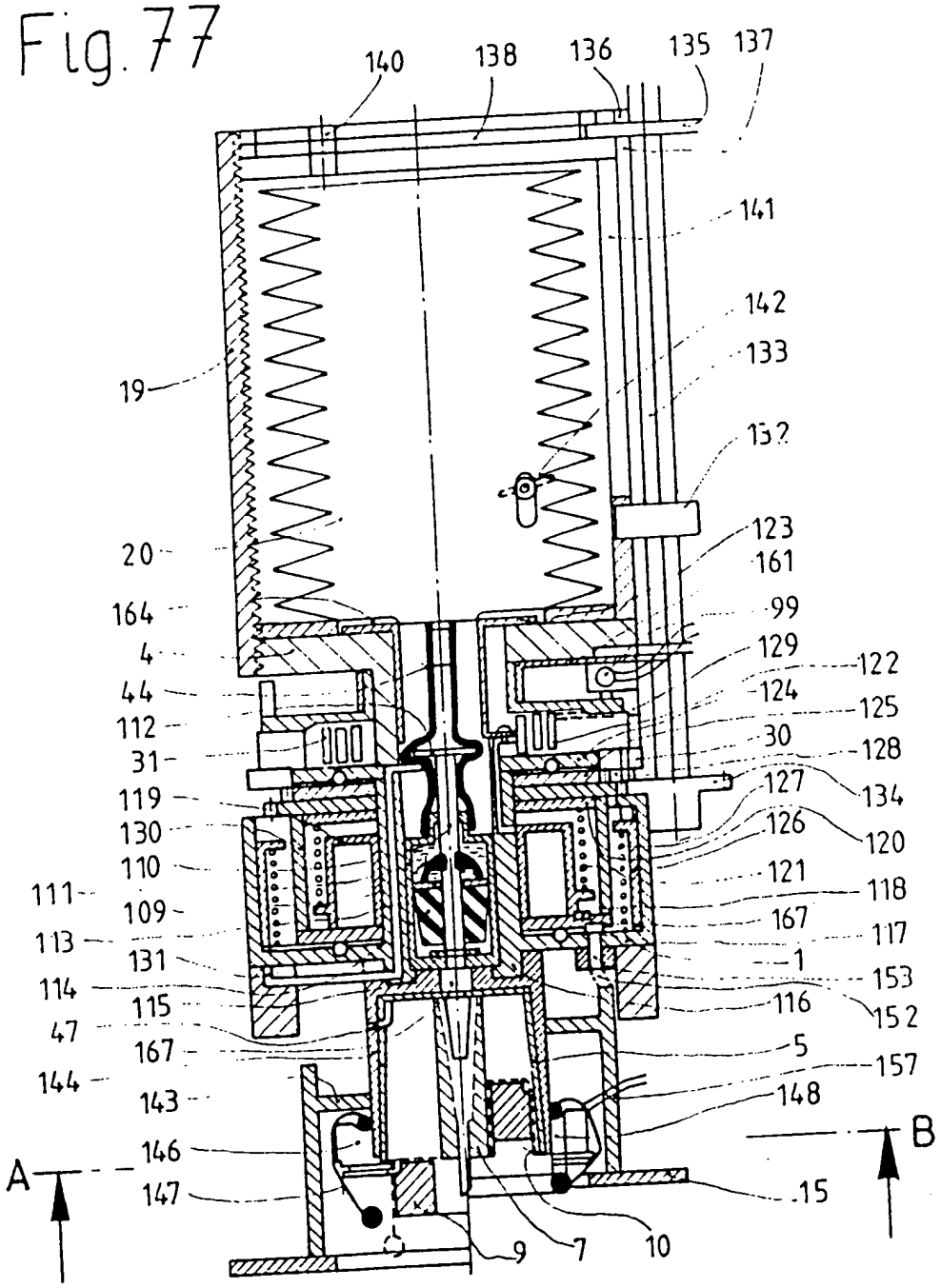


Fig. 76

Fig. 77


140
138
136
135
137
141
142
133
132
19
20
123
161
99
164
4
129
122
44
124
125
112
30
128
31
127
134
119
126
120
130
110
121
118
111
109
167
117
113
131
1
153
114
116
152
115
47
5
167
157
144
143
148
146
B
A
147
15
9
7
10

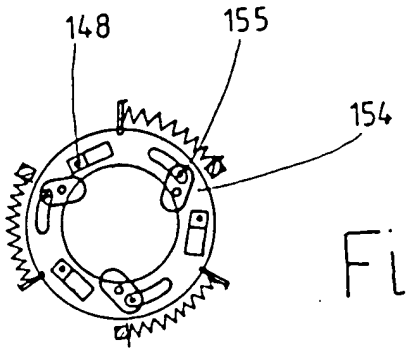


Fig. 78

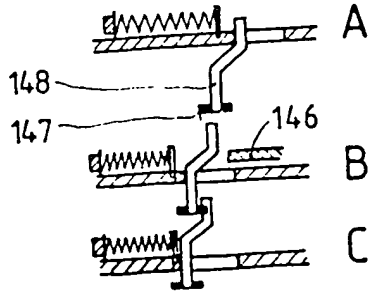


Fig. 79

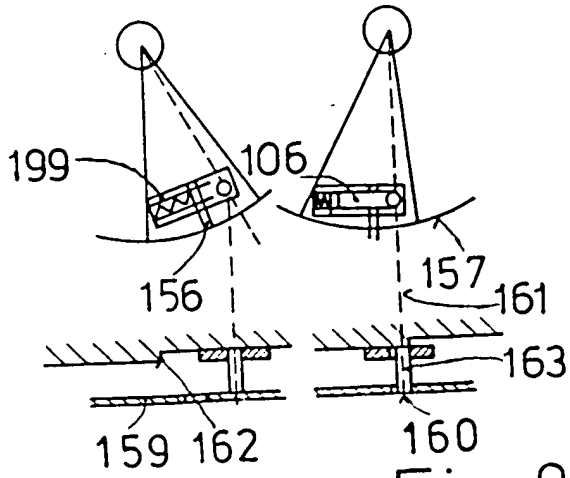


Fig. 80

Fig.81

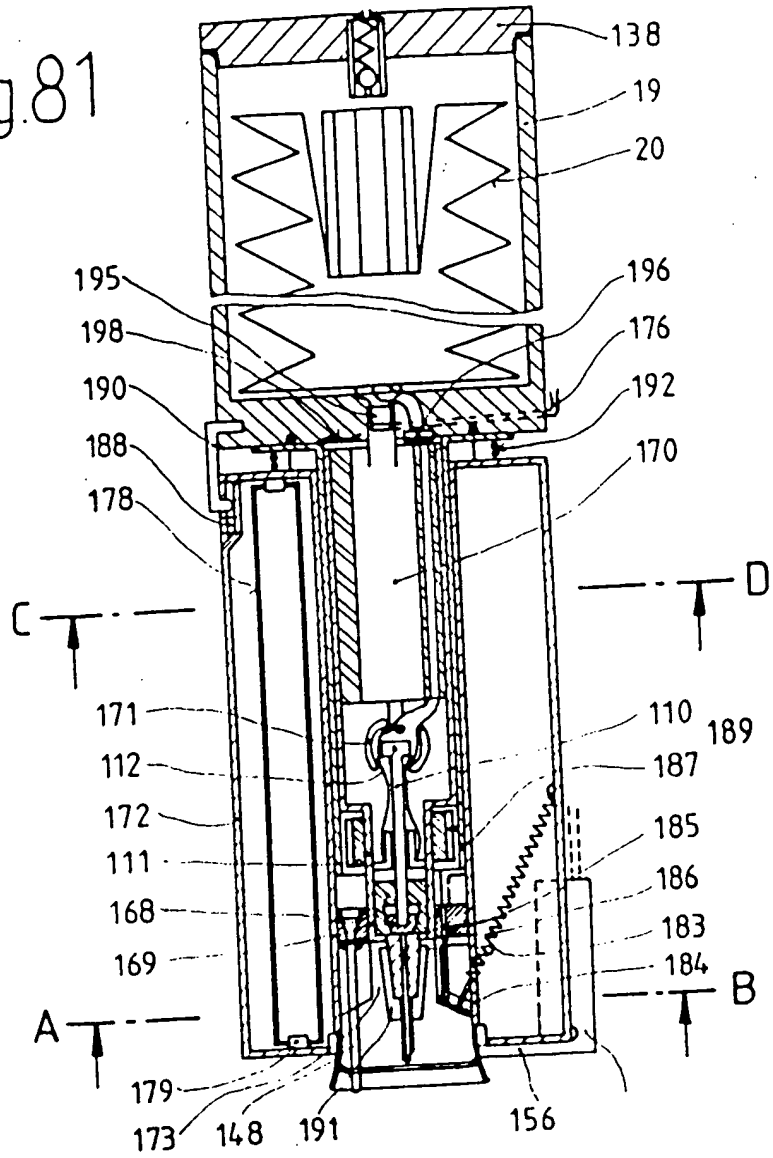
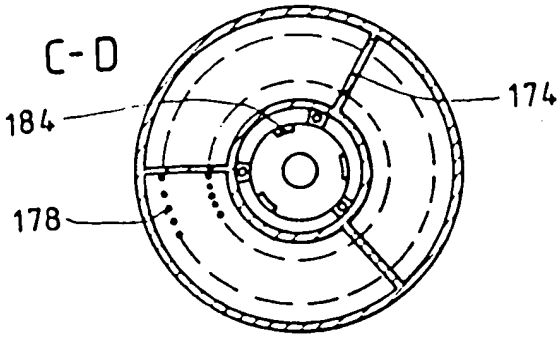

138
19
20
195
196
198
176
190
192
188
170
178
C
D
171
110
189
112
187
172
185
111
186
168
183
169
184
A
B
179
173
148
191
156

Fig.82


C-D
184
174
178

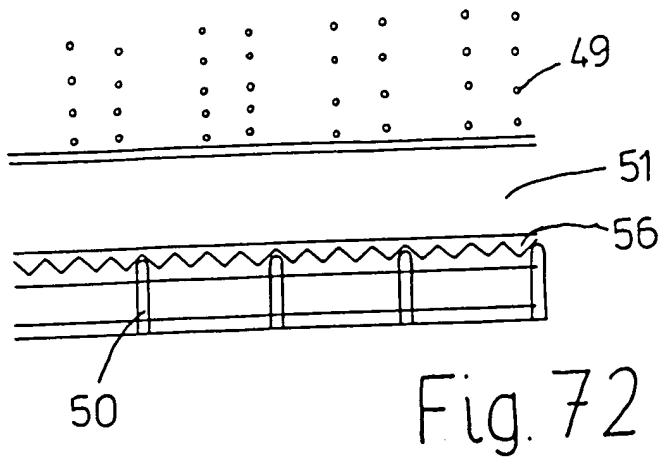


Fig. 72

Fig. 83

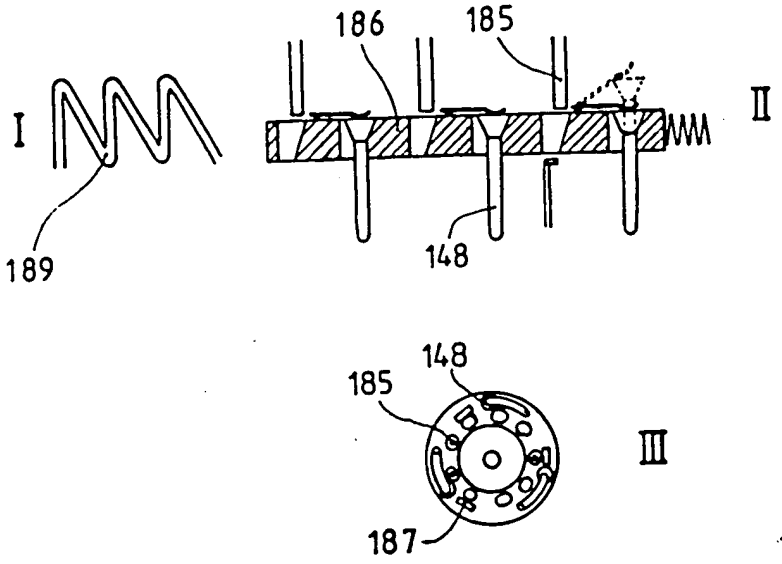


Fig.84

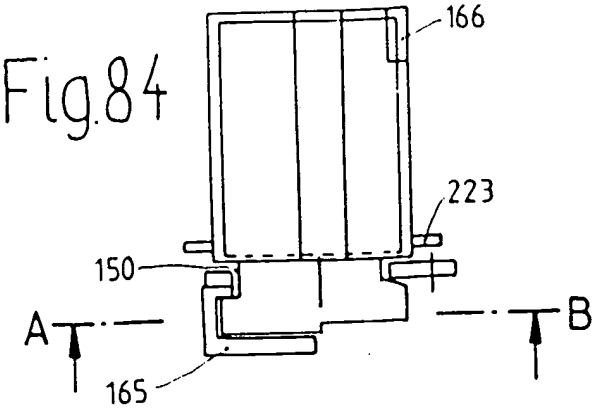


Fig.87

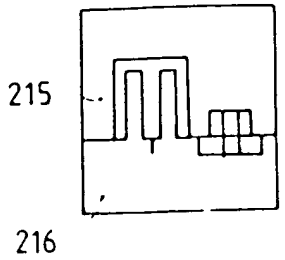
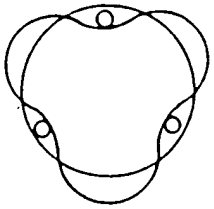
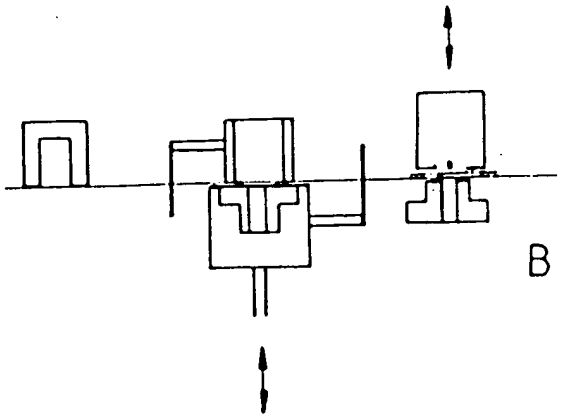


Fig.85





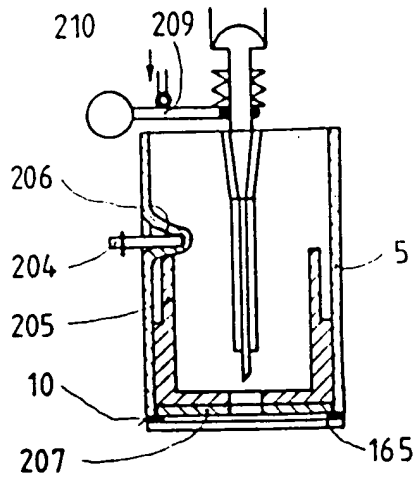


Fig.86

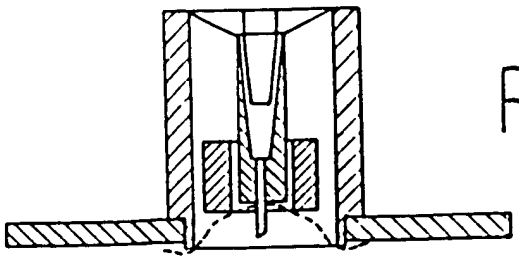


Fig.88

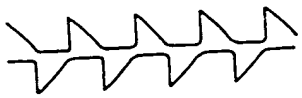


Fig.89

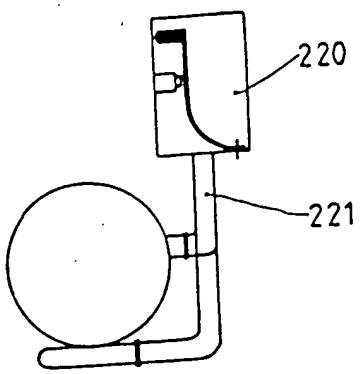


Fig.90

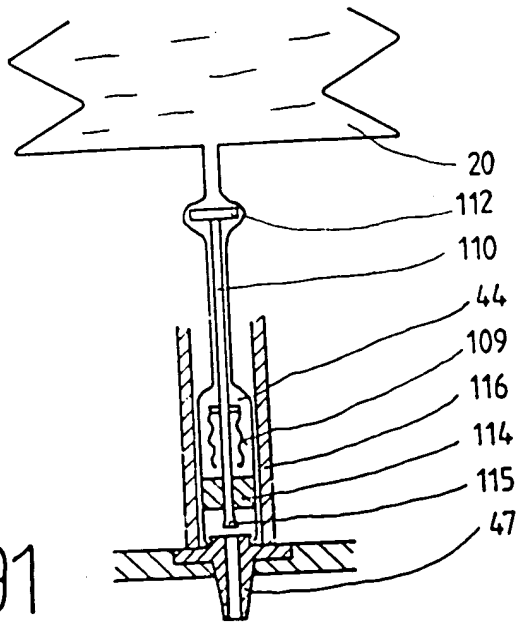


Fig.91

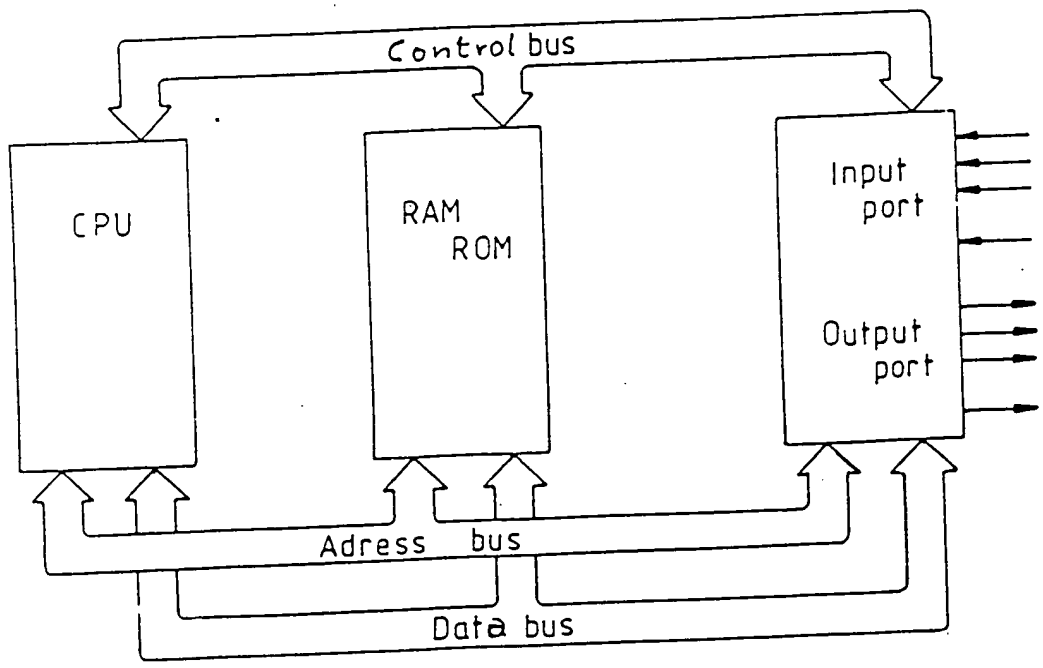

Control bus
CPU
RAM
ROM
Input
port
Output
port
Adress bus
Data bus

Fig. 92

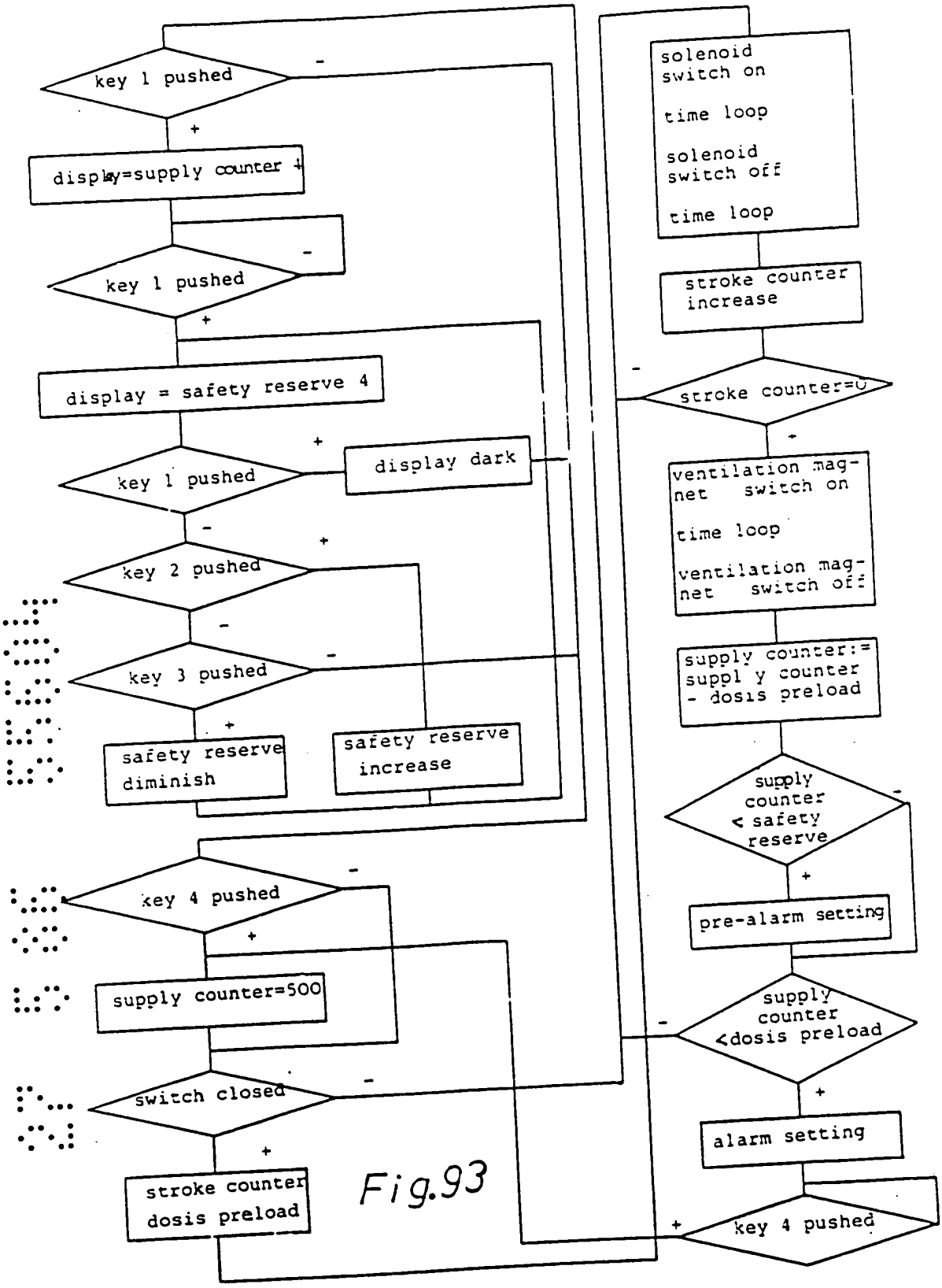

key 1 pushed
display=supply counter
key 1 pushed
display = safety reserve 4
key 1 pushed
display dark
key 2 pushed
key 3 pushed
safety reserve diminish
safety reserve increase
key 4 pushed
supply counter=500
switch closed
stroke counter dosis preload
solenoid switch on
time loop
solenoid switch off
time loop
stroke counter increase
stroke counter=0
ventilation magnet switch on
time loop
ventilation magnet switch off
supply counter:= supply counter - dosis preload
supply counter < safety reserve
pre-alarm setting
supply counter <dosis preload
alarm setting
key 4 pushed

Fig.93

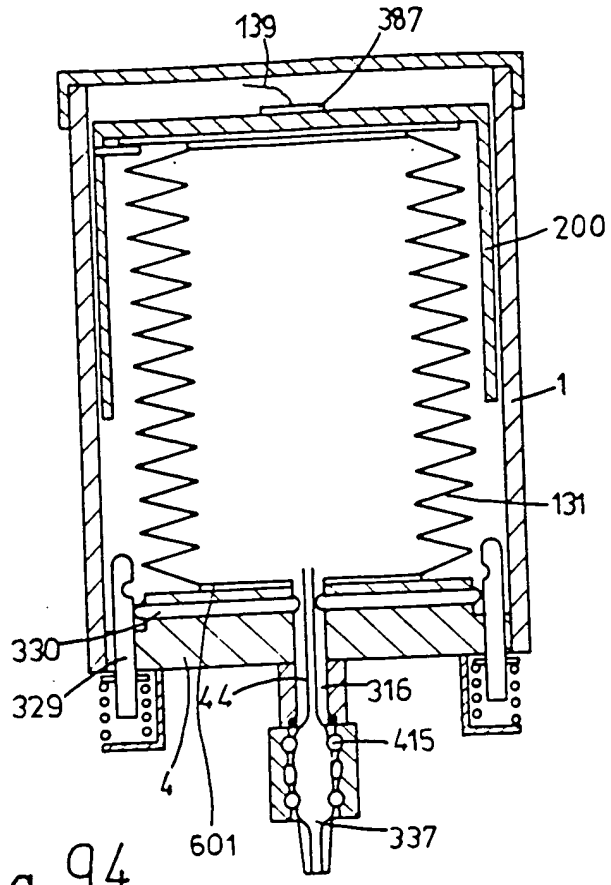

139
387
200
1
131
330
329
44
316
415
4
601
337

Fig. 94

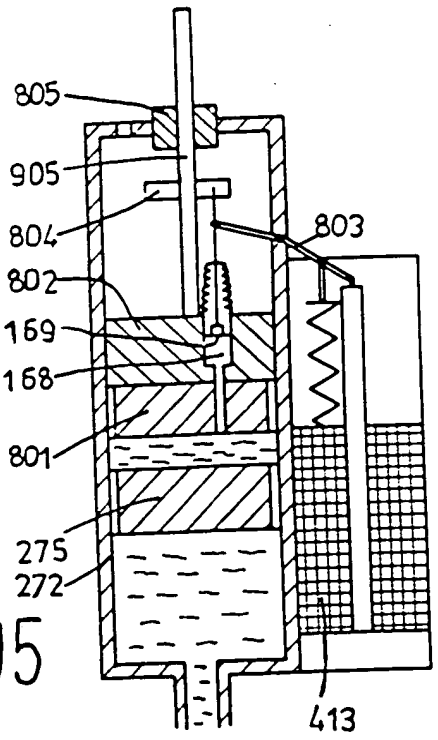
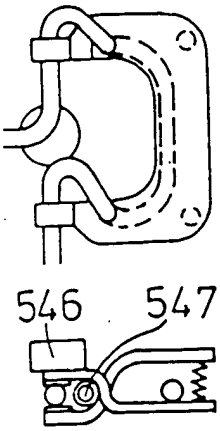

805
905
804
803
802
169
168
801
275
272
413

Fig. 95



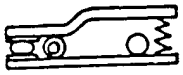


Fig. 96

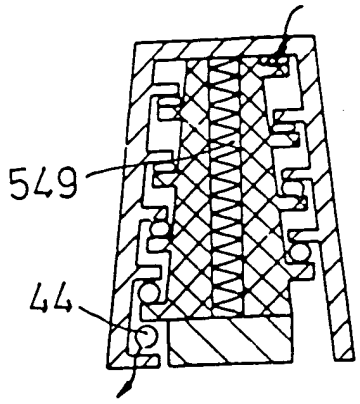


Fig. 97

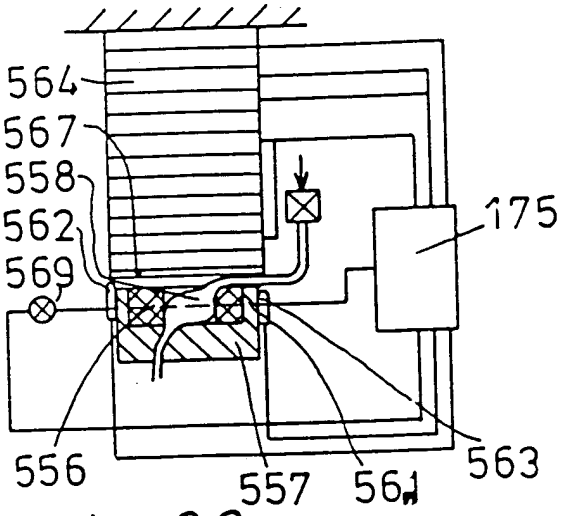
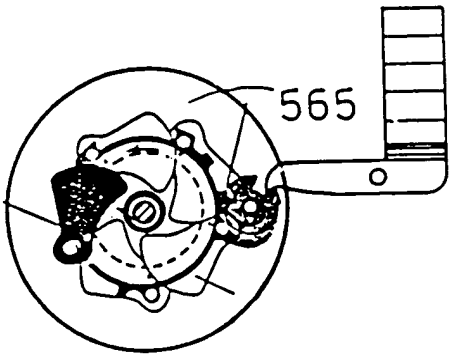


Fig. 98



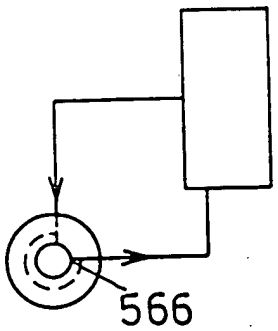


Fig. 99

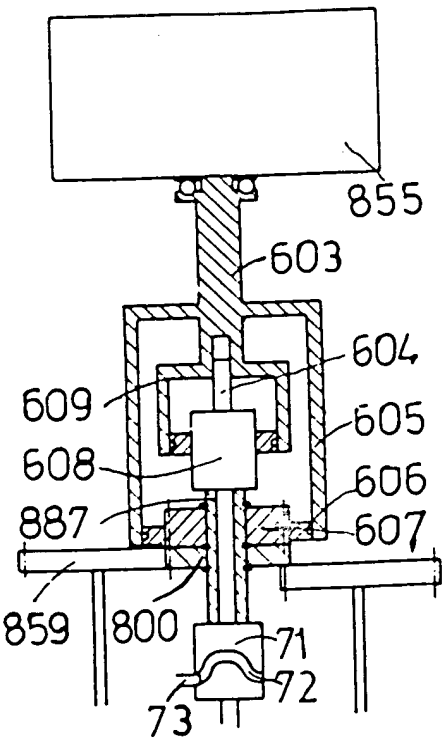
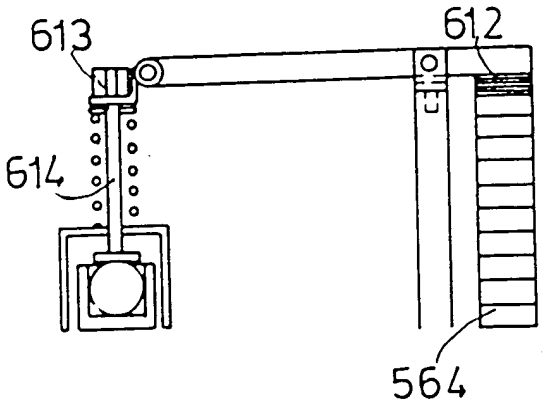


Fig. 100



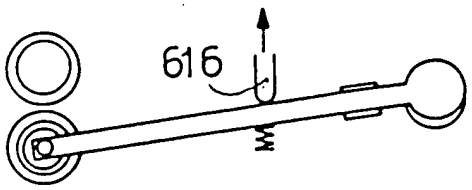
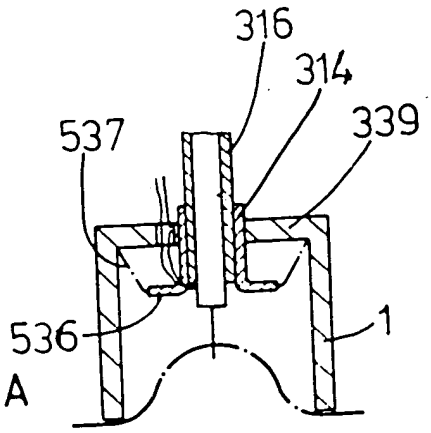


Fig. 101



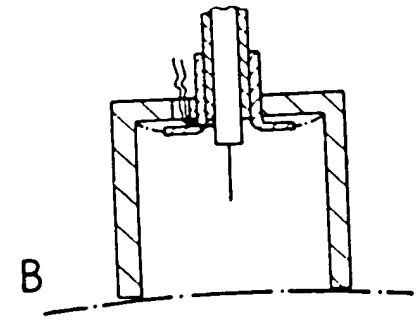
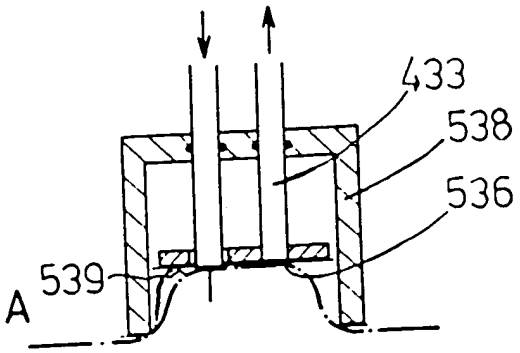
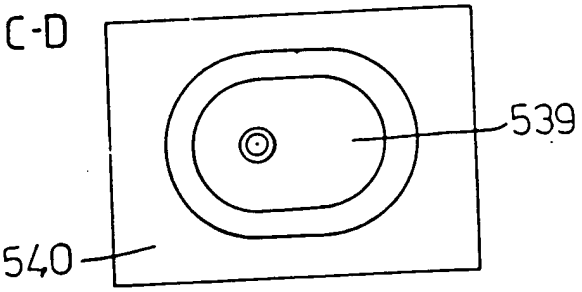


Fig. 102





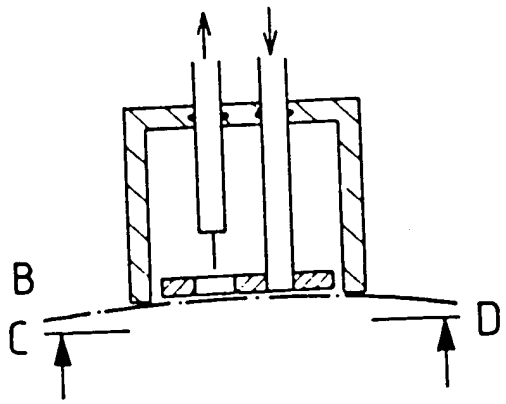


Fig. 103

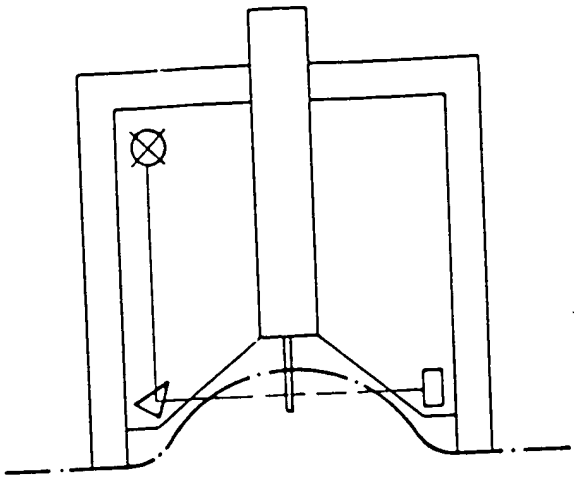


Fig. 104

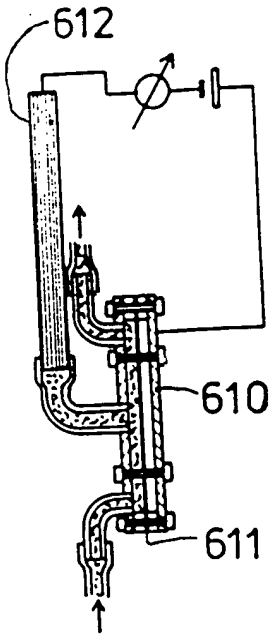
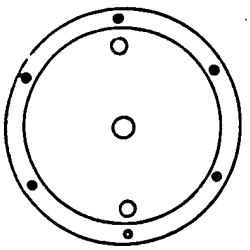


Fig. 105



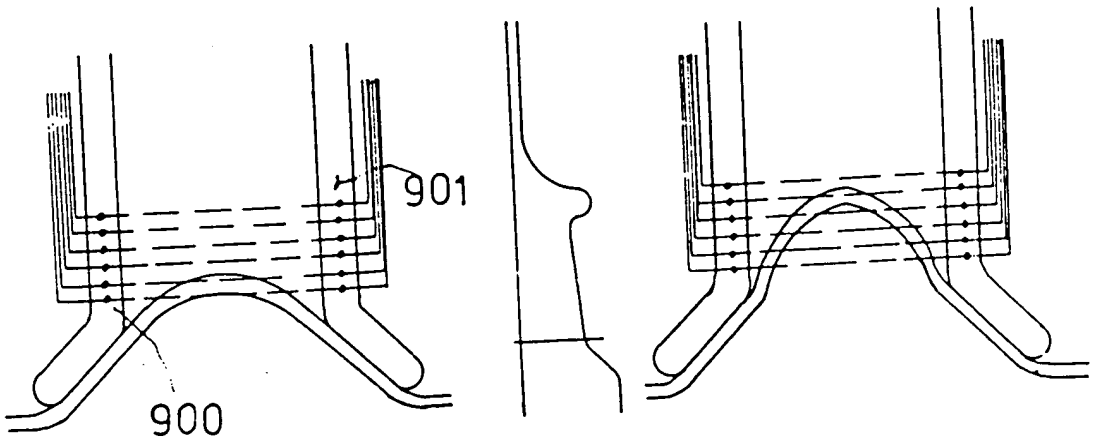


Fig. 106

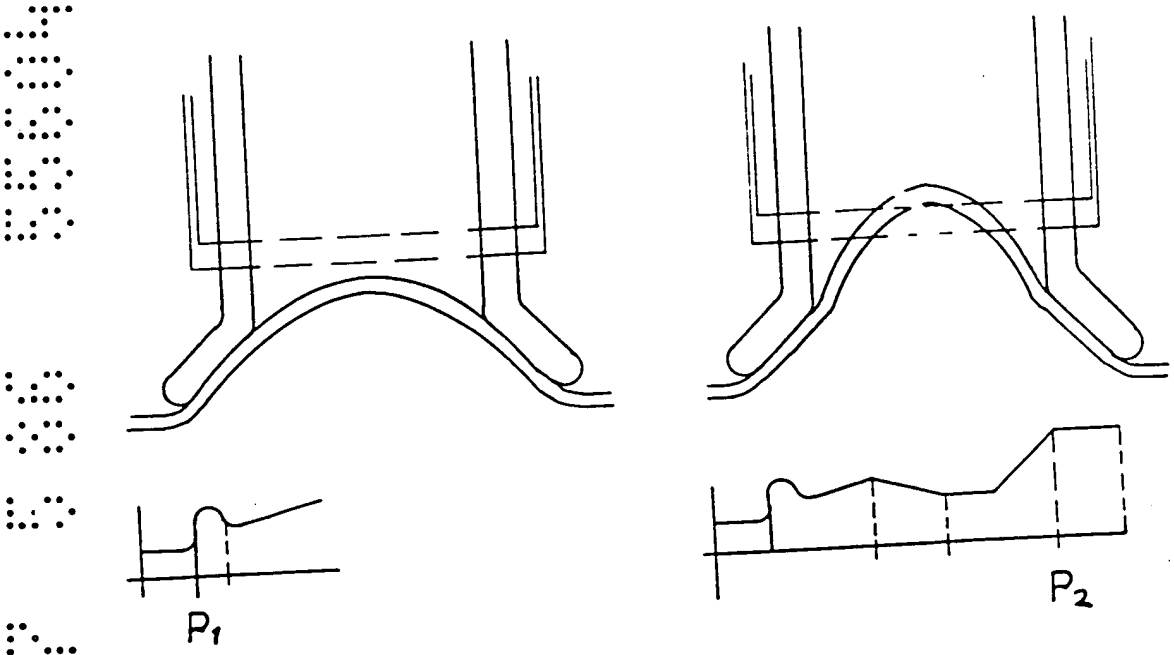


Fig. 107

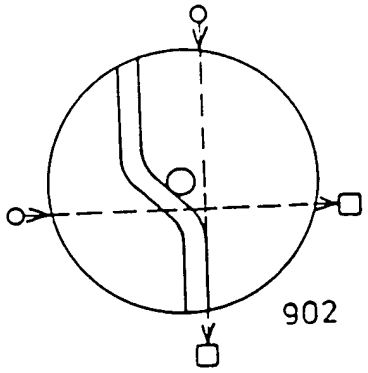


Fig. 108

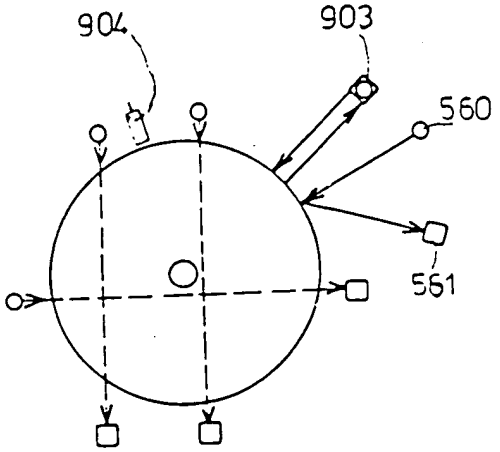


Fig. 109

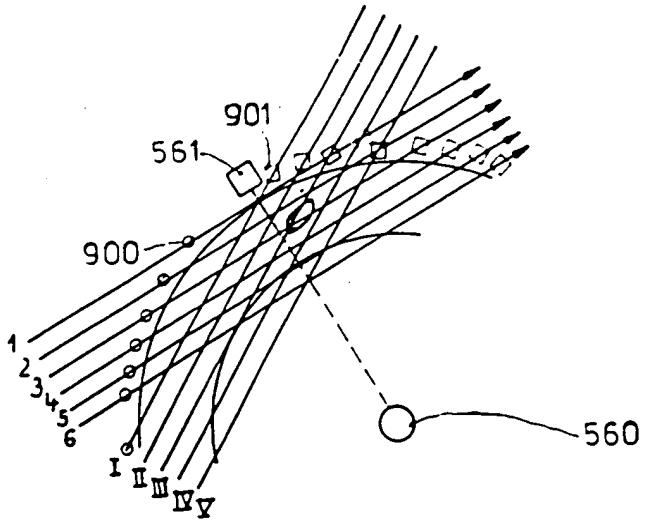


Fig. 110

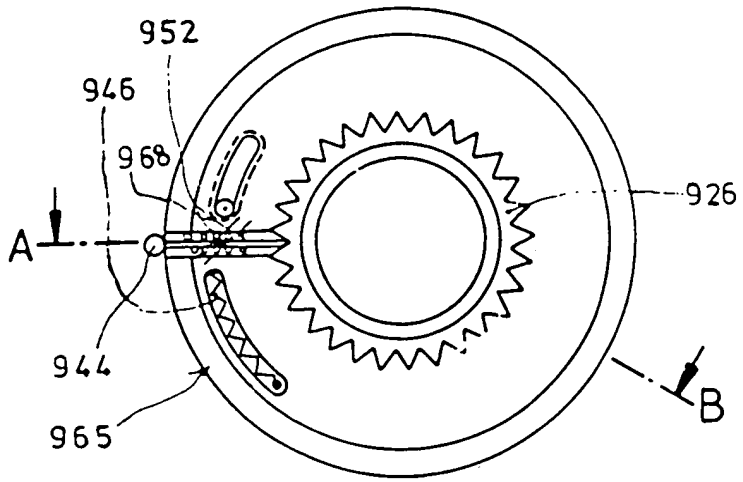
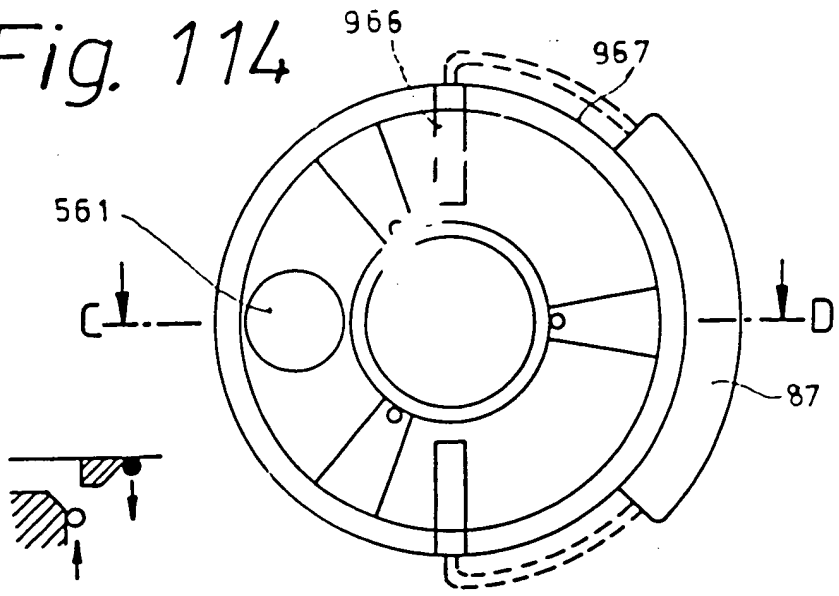


Fig. 113

Fig. 114



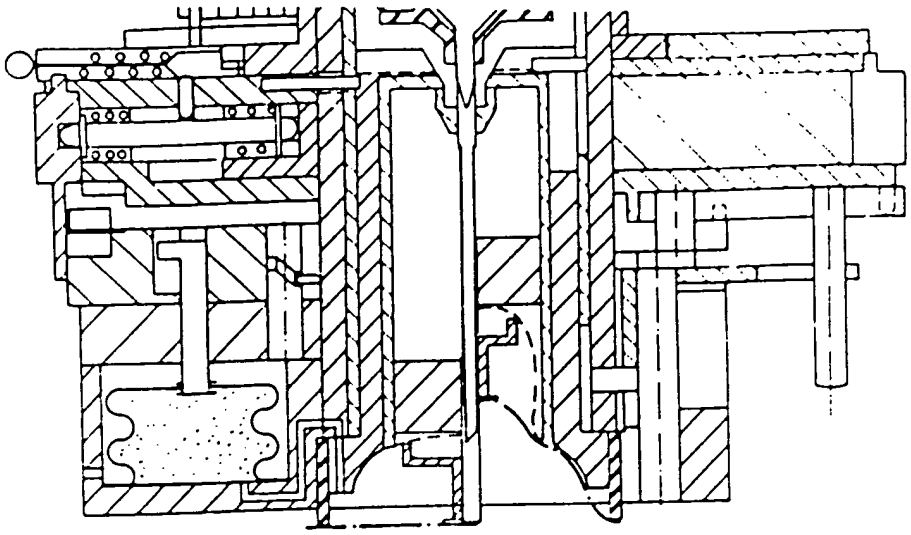
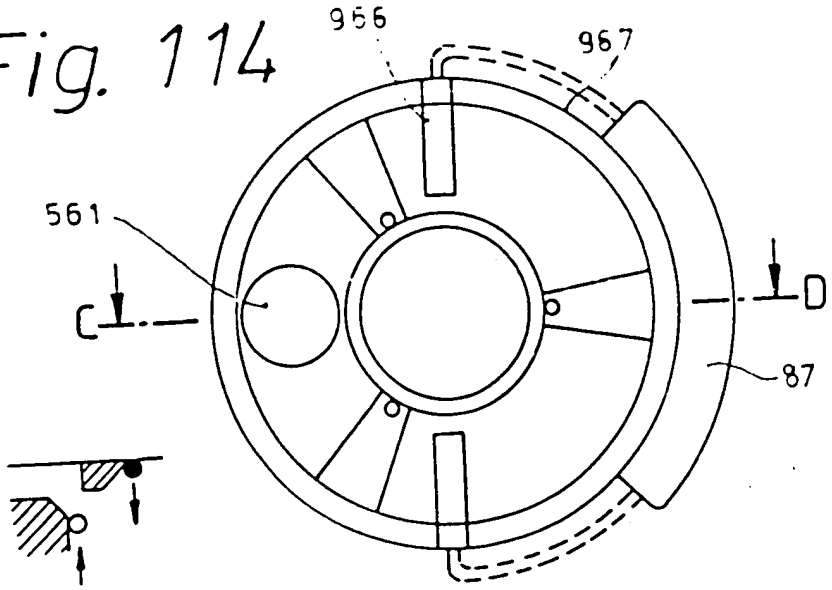


Fig. 114



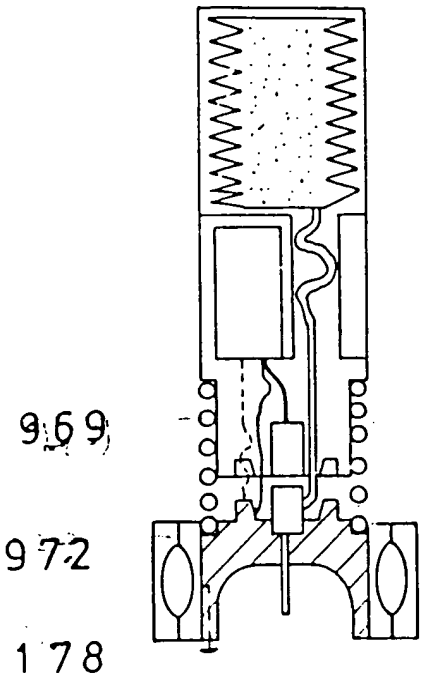


Fig. 115

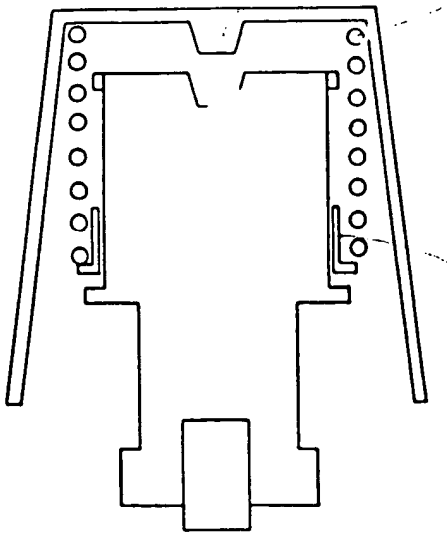


Fig. 116

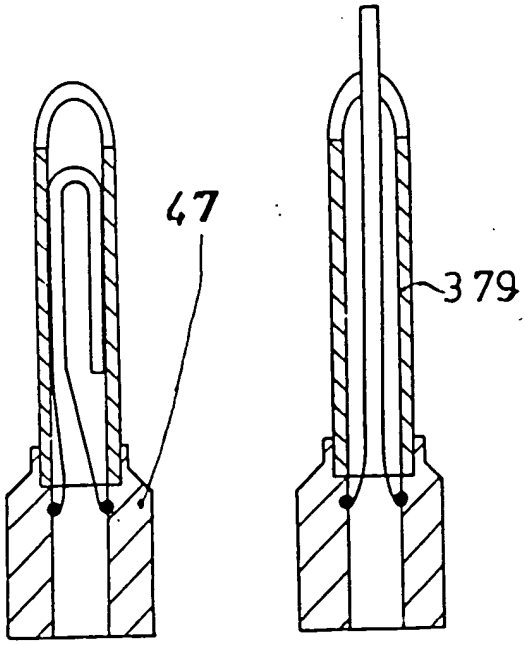


Fig.117

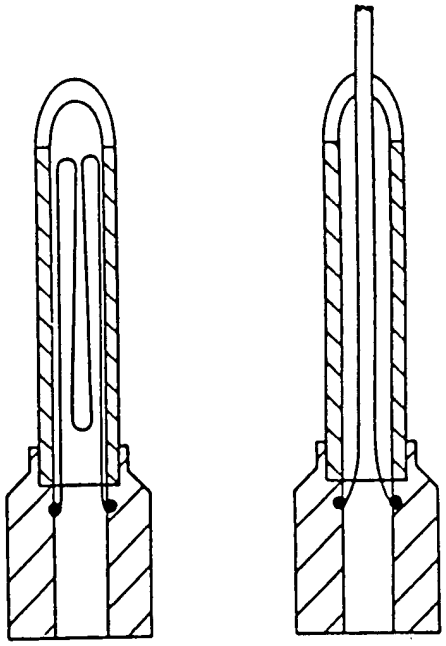


Fig.118

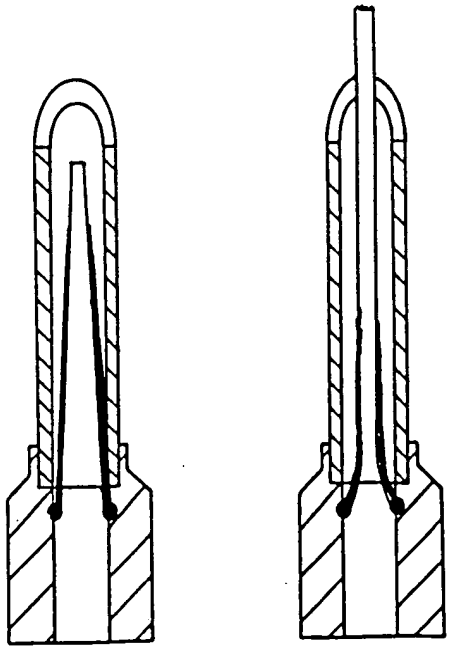


Fig.119

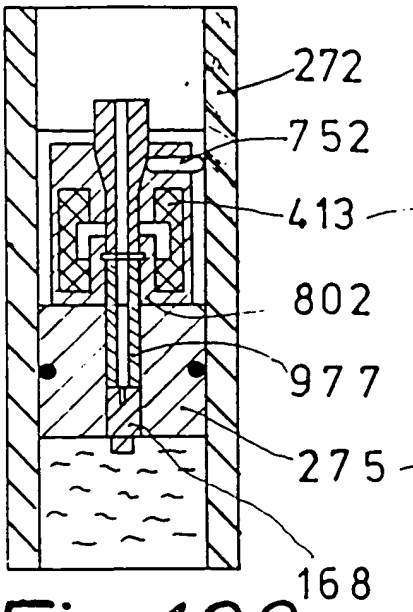


Fig.120

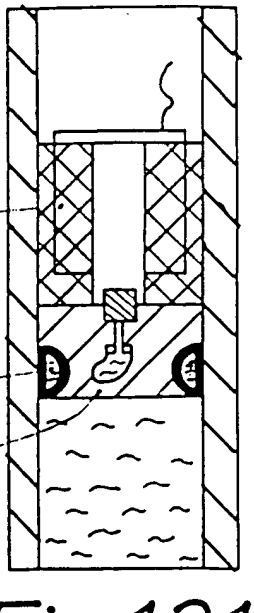


Fig.121

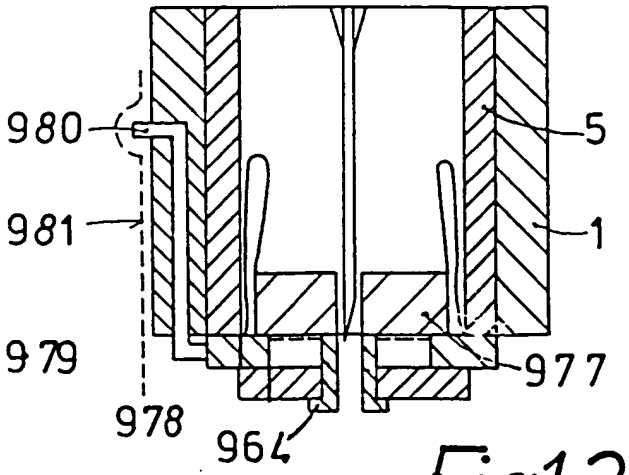
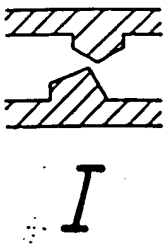


Fig.122



I